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The assessment of disaster risk reduction strategies in dairy supply chains in Zimbabwe

BY

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Abstract

Disasters are on the increase globally with devastating effects. The devastation caused by these disasters in various countries highlights the need for increased commitment and investment, by government and various stakeholders, in disaster risk reduction. This study investigated disaster risk reduction strategies in Zimbabwe's dairy supply chains. The study was initiated on the premise that Zimbabwe is at high risk and vulnerable to natural and man-made hazards. The study is set in the backdrop of declining output across all agricultural sectors evident particularly in the dairy farming sector that has seen inadequate supply of raw milk and dairy products by local producers in Zimbabwe. This study therefore sought to assess the collaborative strategies by government, dairy organisations and dairy supply chain stakeholders to reduce disaster risks in the dairy industry.

The study employed a mixed-method approach (qualitative and quantitative) to investigate collaborative disaster risk reduction strategies used by dairy supply chain stakeholders to avoid supply chain disruptions. The study used a sample size of 92 dairy farmers, from major milk producing regions of Zimbabwe, for the questionnaire. The Cronbach alpha test for reliability showed a reliable questionnaire. Furthermore, the study used information from key informants, 30 retailers and 20 dairy officers for one-on-one interviews. Quantitative data was analysed using STATA (version 13). OLS regression analysis was done and results were compared with those of the Tobit models as a test for robustness of the results. Qualitative data was analysed using thematic analysis derived from observations and interviews and descriptive statistics presented in tables and bar charts.

Notable in the literature reviewed is lack of coordination amongst stakeholders in strategies to reduce disaster risks in dairy supply chains in Zimbabwe. This study adopted a collaborative proactive framework and tested it as a strategy to reduce disaster risks in dairy supply chains. The study gives four major findings. Firstly, dairy supply chains in Zimbabwe were exposed to a number of risks which are: international

competition, competition from local giants, financial risks, political risks, technological risks, environmental risks and production risks. Secondly, findings from regression analysis indicated that an overall index of disaster risks significantly influenced job losses, food security, milk productivity and growth of ventures in dairy businesses. Thirdly, there were isolated cases of planned coordination by stakeholders in the industry to reduce the negative effects of disasters across the supply chain. There was collaboration among dairy farmers, processors, NGOs, and government departments of agriculture and environment. Fourthly, an index of collaborative strategies regressed against dependent variables of variables of supply chain cost, lead time milk sales, and variety and quality of milk demonstrated that collaborative strategies in dairy supply chain significantly influenced supply chain costs and variety and quality of milk and milk products.

It is expected that the study will assist government in the formulation of public policies for the dairy sector leading to improved access to high quality raw milk and milk products for consumers thus resulting in improved nutrition and food security for the people of Zimbabwe. Policy recommendations highlight that instead of the current maximum of the 5 year lease given to white commercial farmers, the government should consider issuing out long term leases in order to protect long-term investment in dairy projects. Government should, therefore, create an enabling environment for stakeholder partnerships in the dairy sector.

Key words: disaster, dairy farmers, collaboration, dairy, dairy supply chain risks, vulnerability.

CONTENTS

Declaration ii
Acknowledgements iii
Abstract iv
CONTENTS vi
List of Tables xii
List of Figures xiv
List of Acronyms xv
Chapter 1 1
Introduction and background 1
1.1 Introduction and background of the study 1
1.2 Statement of the problem 6
1.3 Purpose of the Study 7
1.4 Contribution of the study 7
1.5 Objectives of the Study 7
1.6 Research questions 8
1.7 Theoretical Framework 8
1.8 Assumptions 9
1.9 Limitations of the study 9
1.10 Scope of Study 9
1.11 Definition of terms 9
1.12 Structure of the thesis 10
1.13 Conclusion 11
Chapter 2 12
An international perspective 12
2.1 Introduction 12
2.2 Disaster risks: a conceptual framework 12
2.3 Vulnerability to disasters 14
2.4 Disasters in developed and developing countries 19
2.5 The concept of supply chain 21
2.6 Impact of disasters on supply chains in developed and developing countries 22

2.7 Disaster risk management 27
2.8 Disaster risk reduction 28
2.9 Collaboration strategies and disaster risks 33
2.10 Supply chain collaboration 38
2.11 Disaster risk reduction in dairy industry 40
2.12 Conclusion 43
Chapter 3 44
Disaster risk reduction in dairy supply chains: A Zimbabwe perspective 44
3.1 Introduction 44
3.2 Disasters Plaguing Zimbabwe 44
3.2.1 Droughts ----- 44
3.2.2 The 1992 Drought in Zimbabwe ----- 45
3.2.3 The 1995 Zimbabwe Drought ----- 46
3.2.4 The 2008 Drought in Zimbabwe ----- 46
3.2.5 The 2015/2016 Drought in Zimbabwe ----- 47
3.3 Flood Disasters in Zimbabwe 47
3.4 Cyclones 48
3. 5 Road Disasters in Zimbabwe 49
3.6 Veld fires 49
3.7 Animal diseases 50
3.8 Armyworm and Locusts 50
3.9 Human diseases 50
3.10 Supply chain risks plaguing the Zimbabwe Diary Industry 52
3.10.1 Financial risks ----- 52
3.10.2 Input risks ----- 53
3.10.3 Political risks ----- 55
3.10.4 Competition risks ----- 57
3.10.5 Natural disaster risks ----- 58
3.10.6 Technology risks ----- 59
3.11 The disaster risk reduction legal framework in Zimbabwe 59
3.11.1 Civil Defence Act of 1982 ----- 60
3.11.2 Civil Protection Act 1989 ----- 61

3.11.3 Zimbabwe Civil Protection Act of 2001 ----------61
3.11.4 Emergency Preparedness and Disaster management Bill----------62
3.11.5 Zimbabwe Environmental Management Act 13 of 2002----------63
3.11.6 The Zimbabwe National Water Act No. 31 of 1998 and the Zimbabwe----------63
National Water Authority (ZINWA) Act No. 11 of 1998----------63
3.11.7 The Zimbabwe Meteorological Services Act of 1990----------64
3.11.8 Zimbabwe statutory instrument 64, 2016 ----------64
3.12 Disaster risk reduction strategies in Zimbabwe 65
3.12.1 Early Warning Systems ----------65
3.12.2 Legislation----------66
3.12.3 Zimbabwe National Contingency Plan----------66
3.12.4 International assistance ----------67
3.12.5 Policy ----------67
3.12.5.1 Comprehensive Agricultural Policy Framework (2012-2032) ----------67
3.12.6 Education, training and awareness----------68
3.12.7 Insurance ----------68
3.12.8 Cooperatives----------69
3.12.9 Technology----------69
3.13 Collaboration in disaster reduction in Zimbabwe's dairy supply----------70
chain----------70
3.14 Challenges thwarting mitigation efforts 71
3.15 Conclusion 72
Chapter 4 73
Research Design and Methodology 73
4.1 Introduction 73
4.2 Objectives 73
4.3 Research paradigm 73
4.3.1. Positivism----------74
4.3.2 Interpretivism ----------74
4.3.3 Pragmatism ----------75
4.4 Research design 75
4.5 Research methodology 77

4.5.1 Dairy farmers questionnaire ----------77
4.5.2 The sampling process----------79
4.5.2.1 Target population ----------79
4.5.2.2 Sampling frame----------79
4.5.2.3 Sample size ----------79
4.5.2.4 Sampling techniques----------79
4.6 Reliability of data 80
4.7 Validity of data.....80
4.8 Ethical principles and considerations 81
4.9 Data collection Procedures 82
4.10 Data analysis and interpretation.....83
4.11 Semi-structured interviews with dairy officers and retailers.....83
4.12 Sampling process.....84
4.12.1 Sample size ----------84
4.12.2 Judgmental purposive sampling----------84
4.12.3 Ethical principles and considerations ----------85
4.12.4 Data analysis ----------85
4.13 Observations.....85
4.14 Conclusion.....86
Chapter 5.....87
Data analysis, presentation and discussion.....87
5.1 Introduction.....87
5.2 Demographic Data.....87
5.3 Reliability test 91
5.4 Disaster risks affecting dairy supply chain.....91
5.5 Impact of disaster risks on dairy supply chain performance 100
5.6 Overall effect of disaster risks on job losses, food security, depletion of dairy herd, hindered growth of dairy firms and quantity and quality of milk 128
5.7 Collaborative strategies 131
5.8 Impact of collaborative strategies.....134
5.9 Challenges for collaboration 147
5.10 Conclusion.....149

Chapter 6..... 150

Conclusions and Recommendations..... 150
6.1 Introduction..... 150
6.2 Conclusion..... 150
6.3 Recommendations for future researchers..... 151
6.4 Limitations of the study..... 152
6.5 Recommendations..... 152
REFERENCES..... 156
APPENDICES..... 182
Appendix I:..... 182
Appendix II:..... 183
Appendix III..... 184
Appendix IV:..... 185
Appendix V:..... 186
Appendix VI..... 187
Appendix VII:..... 188
Appendix VIII:..... 189
Appendix IX:..... 190
Appendix X..... 191
Appendix XI: Tobit estimates of impact of milk and packaging technology on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity..... 192
Appendix XII:..... 193
Appendix XIII:..... 194
Appendix XIV:..... 195
Appendix XV:..... 196
Appendix XVII:..... 198
Appendix XVIII:..... 199
Appendix XIX:..... 200
Appendix XX:..... 201
Appendix XXI..... 201
ANNEXURE..... 203

Questionnaire.....203
Appendix XXII.....212
Appendix XXIII:.....214
Appendix XXIV.....215
Appendix XXV.....217

List of Tables

Table 5:1 Financial risks by gender 92
Table 5:2 Competition risks by experience 93
Table 5:3 Socio-political risks by region 94
Table 5:4 Environmental risks by region 97
Table 5:5 Technological challenges by age 98
Table 5:6 Production risks by experience 99
Table 5:7 Impact of disaster risks by tenure 100
Table 5:8 OLS estimates of impact of interest rates risk on job losses, food security,. 101
Table 5:9 OLS estimates of impact of local giants dictating in the market on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 103
Table 5:10 OLS estimates of impact of international competition on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 105
Table 5:11 OLS estimates of impact of government policy on job losses, food security, depletion of dairy herd, hindrance to growth and milk..... 107
Table 5:12 OLS estimates of impact of political interference on job losses, food security, depletion of dairy herd, hindrance to growth and milk..... 109
Table 5:13 : OLS estimates of impact of drought on job losses, food security, depletion of dairy herd, hindered growth and quality of milk 111
Table 5:14 OLS estimates of impact of cattle diseases on job losses, food security, depletion of dairy herd, hindrance to growth and milk..... 113
Table 5:15 OLS estimates of impact of cyclones on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity..... 115
Table 5:16 OLS estimates of impact of extreme cold weather on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 117
Table 5:17 OLS estimates of impact of feeds processing technology on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 119

Table 5:18 OLS estimates of impact of milking and packaging equipment on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 121
Table 5:19 OLS estimates of impact of power outages on job losses, food security, depletion of dairy herd, hindered growth and milk productivity. 123
Table 5:20 OLS estimates of impact of labour costs on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 125
Table 5:21 OLS estimates of impact of cost of breeding on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. 127
Table 5:22 OLS estimates of impact of disaster risks on job losses, food security, depletion of dairy herd, hindrance growth and milk productivity. 129
Table 5:23 Collaborative strategies in use by region 131
Table 5:24 Impact of collaborative strategies by experience in dairy 134
Table 5:25 OLS estimates for the impact of NGOs on supply chain costs, lead time, milk sales and milk variety and quality. 135
Table 5:26 OLS estimates of the impact of collaboration with Agriculture ministry on supply chain costs, lead time, milk sales and milk variety and quality. 137
Table 5:27 OLS estimates of the impact of collaboration with Education ministry on supply chain costs, lead time, milk sales and milk variety and quality. 139
Table 5:28 OLS estimates on the impact of collaboration with environment ministry on supply chain costs, lead time, milk sales and milk variety and quality. 141
Table 5:29 OLS estimates on the impact of cooperative association on supply chain costs, lead time, milk sales and milk variety and quality. 143
Table 5:30 OLS estimates of the impact of collaborative strategies on supply chain costs, lead time, milk sales and milk variety and quality. 145
Table 5:31 Challenges for collaboration by years of experience 147

List of Figures

Figure 2:1 Pressure and Release (PAR) model: the progression of vulnerability .....**Error! Bookmark not defined.**

Figure 2:2 The release of “pressures” to reduce disaster: progression to Safety. 18

Figure 2:3 Disaster management cycle 28

Figure 5:1 Gender of respondents 87

Figure 5:2 Age of respondent..... 88

Figure 5:3 Educational attainments of respondents 89

Figure 5:4 Location of respondents..... 90

Figure 5:5 Dairy farmer experience..... 90

List of Acronyms

ADB	African Development Bank
ADB	Asian Development Bank and
ADBI	Asian Development Bank Institute
AMA	Environmental Management Agency
ANZAM	Australian New Zealand Academy of Management
CARICOM	Caribbean Communities
CDERA	Caribbean Disaster Emergency Response Agency
CFU	Commercial Farmers' Union
CNCIDR	Chinese National Committee for International Disaster Reduction
CNDR	Corporate Network for Disaster Response
CPU	Civil Protection Unit
CRED	Centre for Research on the Epidemiology of Disasters
DCP	Department of Civil Protection
DDP	Dairy Development Programme
DMA	Disaster Management Act
DMB	Dairy Marketing Board
DPPC	Disaster Prevention and Preparedness Commission
DRFIP	Disaster Risk Financing and Insurance Programme
DRR	Disaster Risk Reduction
EC	European Commission
EWS	Early Warning Signs
FAO	Food and Agricultural Organisation
FFP	Free Food Programme
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GFFDRR	Global Facility for Disaster Reduction and Recovery
GLS	Grain Loan Scheme

GSDRC	Governance and Social Development Resource Centre
HDI	Human Development Index
HFA	Hyogo Framework of Action
HIV/AIDS	Human immunodeficiency virus infection and acquired immune deficiency syndrome
IDNDR	International Decade for Natural Disaster Reduction
IFRCRCS	International Federation of Red Cross and Red Crescent Societies
ISDR	International Strategy for Disaster Reduction
LLRM	Local Level Risk Management Approach
MCC	Milk Collection Centres
NADF	National Association of Dairy Farmers
NDRP	National Disaster Reduction Plan
NGO	Non-Governmental Organisation
OLS	Ordinary Least Squares
PAR	Pressure and Release
PWC	PricewaterhouseCoopers
RBZ	Reserve Bank of Zimbabwe
SADC	Southern African Development Community
SADC	Southern African Development Community
SANDMF	South African National Disaster Management Framework
SCCRRT	Supply Chain Council Risk Research Team
SFP	Supplementary Feeding Programme
SNV	Stichting Nederlandse Vrijwilligers
UN	United Nations
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	UN Office for the Coordination of Humanitarian Affairs
USA	United States of America
USAR	National Urban Search and Rescue

WFP	World Food Programme
ZADF	Zimbabwe Association for Dairy Farmers,
ZAMCOM	Zambezi Watercourse Commission
ZESA	Zimbabwe Electricity Supply Authority
ZimACP	Zimbabwe Agricultural Competitive programme
ZimVac	Zimbabwe Vulnerability Assessment Committee
ZINWA	Zimbabwe National Water Authority
ZNCC	Zimbabwe National Chamber Of Commerce

Chapter 1

Introduction and background

1.1 Introduction and background of the study

The successful transmission of goods/ materials and services requires a transparent supply chain network that will meet the current and future global demands. Disruptions to the supply chain network will have a negative impact on a country, a company or individuals. Recent research on ASEAN countries indicate that imports of agricultural products increase while exports decline after each major disaster. Due to interlinkage of economies across the world, nations are sensitive to disasters regardless of nations' geographical position (Reddy, Anbumozhi and Singh 2016: 32). Disruptions in a supply chain system are a consequence of natural or manmade events which may lead to dissatisfaction and closure of many organisations. Natural hazards; particularly droughts, cyclones, wild fires, animal diseases and floods, bring disastrous impacts on agricultural operations and agricultural supply chains negatively affecting business performance by undermining long-term competitiveness and sustainability. Zimbabwe is not spared from these natural hazards for it has already started experiencing the effects of climate change as evidenced by erratic rainfall patterns and extreme temperatures (Brown, Chanakira, Chatiza, Dhliwayo, Dodman, Masiiwa, Muchadeyika, Mugabe, and Zvigadza 2012: 3). According to Sodhi and Tang (2012: 10) the current increase in international trade has given birth to a global supply chain which is longer and complex and in turn it has brought an increased level of disruptions in the same supply chains. Sodhi and Tang (2012: 10) note that in the past 20 years many natural and manmade disasters have been witnessed, causing problems with supply chains of many global companies. Global economic damages from natural disasters have increased from an average annual estimate of US$143 billion to about US$157 billion in 2012 (Guha-Sapir, Hoyois and Below 2012: 1). Major disasters such as the floods in Thailand in 2011 and Hurricane Sandy in 2012 in USA has brought an increased and focused attention on the growing impact of disasters to the private sector.

Zimbabwe experiences a number of natural and manmade disasters that include road traffic accidents, severe climatic and weather conditions, hydro-meteorological disasters, droughts, army worm invasions, floods, electrical power outages and social and political volatility (Betera 2011: 2). These hazards play a major role in disrupting the supply chains in the country, resulting in a decline in dairy industry production and the subsequent collapse of some firms (Commercial Farmers' Union 2010: 4). Zimbabwe in year 2000 experienced a tropical cyclone named Cyclone Eline that caused landslides and flooding. The cyclone also destroyed communication systems and bridges. It also swept away some dwellings (United Nations Country Team 2000). Narrative reports suggest that weather related disasters are likely going to increase in Zimbabwe (Government of Zimbabwe and United Nations 2012: 6).

The dairy sector in the country is not spared from the adverse effects of these natural and manmade hazards. The natural and manmade risks have seriously disrupted dairy production leading to increased prices of diary produce, decreased sales and created perpetual vulnerability. Despite Zimbabwe having a fairly developed dairy processing industry, the recent developments such as complexity of supply chain, long lead times, large numbers of supply chain partners and intense competition from abroad have increased the chances of disruptions in the supply chains.

Zimbabwe's dairy industry is dualised as it constitutes the large commercial sector and the small holder sector (Mugweni and Muponda 2015: 450). Pre-independence agricultural policies made provisions that specifically reserved commercial farming areas were for larger commercial set-ups. The commercial farmers were given the mandate of satisfying national demand constituting 30% from the urban and 70% from rural communities respectively. However, the 30% allocation to rural communities was complimented by supplies from subsistence communal farmers. The location of dairy processors around major towns of Bulawayo, Gweru, Harare, Mutare and Chipinge are a result of policies in the colonial era according to Mupeta (1996: 2); which, however, was a disadvantage to the communal subsistence farmers.

The Economic Structural Adjustment programme of 1991 ushered in the liberalisation of the dairy industry in Zimbabwe (Makamure, Jowa and Muzuva 2001: 5).This programme was geared at improving efficiency and effectiveness of dairy supply chains in Zimbabwe, to allow dairy producers and processors to be more responsive to market needs. The liberalisation of the dairy industry caused disintermediation, a new setup where milk producers are free to pursue new markets and not rely on Dairy Marketing Board (DMB) as a sole milk processor (Makamure *et al.* 2001: 13). This disintermediation as noted by Stichting Nederlandse Vrijwilligers (SNV) (2012: 6) has inflated the transaction costs and impact on the final price of the product. This has seen local dairy products being more expensive compared to the cost friendly foreign dairy imports.

Privatisation of the Zimbabwe dairy industry has led to the entrants of new processors and distributors like Alpha Omega Industries, Dendairy, Dorking Dairies and Kefalos (Zimbabwe Association for Diary Farmers (ZADF) 2013: 5). Zimbabwe has failed to be self-sufficient in terms of producing adequate milk leading to liberalisation of the markets by the government. The liberalisation of markets was expected to bring healthy competition to the local industry. It has, however, practically turned out to be on the contrary in the Zimbabwe dairy sector as demand for local products is more price elastic. The Zimbabwe government extended the concept of commercialisation to include small holder dairy farmers; however, the average milk yield per cow per day could not meet the market demand. Despite the ability of small holder dairy farmers to diversify farming risks and boost national milk productivity and output, national demand for milk and milk products still exceeds supply. The low prices charged on imported milk products have resulted in the reduction in quantity demanded for locally produced milk products. The high costs of breeding dairy cattle translate to very uncompetitive raw milk prices with a cost of US$0.62 per litre compared to neighbouring South Africa and Kenya where the same costs US$0.40 and US$0.30 (Kawambwa, Hendriksen, Zandonda and Wanga 2014: 12)

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Zimbabwe in the 1980s had the status of being the “bread-basket” of Africa with abundant food supplies and a vibrant economy. Agriculture used to be the back-bone of the Zimbabwean economy as it contributed significantly to Gross Domestic Product (GDP). Currently, its contribution to GDP has fallen from 17 % to 13.1% (Anseeuw, Kapuya and Saruchera 2012: 27). The drastic fall was fuelled by recurrent droughts, fuel problems, high input costs, shortage of foreign currency and agricultural inputs. Dairy farming being part of the agricultural sector, has also contributed to the fall in GDP as the country is currently failing to be self-sufficient as far a milk production is concerned. Capacity utilisation in the dairy industry is down to 45 % annually. The country is producing 51 million litres of milk instead of the current demand of 120 million litres annually (Marecha 2013: 1). In Zimbabwe some dairy processing companies have been forced to operate way below full capacity utilisation, creating a cocktail of disasters like job losses, declining GDP, reduced foreign currency earnings and also threatening food security in the dairy industry. To make up for the deficiency, the country has resorted to importing from neighbouring countries.

Dairy imports from neighbouring countries such as South Africa, Botswana, Zambia and Malawi have exposed local products to a stiff competition (Mugweni and Muponda 2015: 450). This competition from the Southern African Development Community (SADC) region has posed a threat that will force farmers out of production as local milk will be more expensive to consumers (Mugweni and Muponda 2015: 450). Once these farmers are out of production, disaster will be fuelled as GDP will continue to fall to an extent where the local dairy supply chains become dysfunctional. Manmade disruptions to the supply chain can be unintentional or deliberate. Manmade hazards involve situations in which the civilian population suffers loss of property, causalities, basic services and means of livelihood. The dairy industry in the country has also fallen victim to the manmade disruptions negatively impacting the way the industry conducts its daily business.

According to Nyakazeya (2016: 6), power cuts are negatively affecting the productivity of some industries. A power cut in the middle of a production process leads to losses,

particularly in the food industry as processes have to run at controlled temperatures. The power available is inadequate to meet national demand requirements as the country has to depend on imports. The effects of power cuts are more evident in the dairy industry where the milk products are highly perishable. This may lead to disruptions in the dairy supply chain where product quality is adulterated. This in turn affects capacity utilisation simultaneously fuelling input costs in the dairy industry as the dairy processors have to consider other sources of power like generators to prevent disruptions in their production lines (Nyakazeya 2016: 6). The high input costs push the price of the final milk products up.

According to Nyamwanza, Mavhiki, Nyamwanza and Chagwesha (2015: 7), low levels of capacity utilisation are a result of weak government policy, shortage of raw materials, high prices of inputs and poor infrastructure. They further argue that inconsistency in supply of raw materials adversely affects capacity utilisation which leads to supply chain disruptions. The influx of milk and milk product imports into the Zimbabwean market at a cheap price has adversely affected production levels in the dairy industry. All the companies surveyed by Nyamwanza *et al.* (2015: 6) felt the impact of the influx of imports as they agreed that capacity utilization was being affected by imports from other countries.

Findings in a study by Nyamwanza *et al.* (2015: 8) on capacity utilization strategies in the milk processing industry in Zimbabwe indicated that the loss of disposable income was causing consumers to prefer low value dairy products. The purchasing power of the ordinary consumer has been drastically eroded with the majority of the people living with incomes below the poverty datum line. On the other hand, the Zimbabwe Vulnerability Assessment Committee (ZimVAC) (2009: 4), reported that low agricultural output was a result of low capital endowment. This has led to a low uptake of productive farm technologies. Kapuya *et al.* (2010: 23) also note that existing unfavourable borrowing conditions, limited access to working capital and difficulties in accessing agricultural finance are also major factors in disrupting the supply chain. The liquidity crunch being experienced in Zimbabwe is impacting negatively on the agricultural sector as a whole.

This man-made disaster is forcing dairy farmers to operate below their full capacity and consequently, farmers are having difficulties in running their farm operations with inadequate inputs. Financial resources enable smooth flow of operations as the farmers are able to procure the required raw material inputs. The limited access to working capital makes farmers vulnerable to disruptions of supply of milk and milk products particularly the dairy processers which lead to a chain reaction where the retailers are also affected. The high perishability of the milk requires efficiency across the supply chain and if not handled well it can lead to dairy disasters stemming from failure of product quality. It is against this background that this study was conceptualised.

1.2 Statement of the problem

Disruptions in the supply chain network in Zimbabwe's dairy industry have adversely affected the national economy, sustainability of dairy firms and individual livelihood. Poor performance across the dairy sector is evidenced by a sharp decrease in the milk production of 50 million litres of milk as opposed to the annual demand of 120 million litres (Phiri 2014: 2-3). Consequently, there is inadequate supply of raw milk and dairy products in the country leading to an unsustainable competition from imported dairy products. The disruptions in the supply chain network have also led to closure of some milk processing factories thereby plunging locals who thrive on farming activities into poverty. It has also negatively affected the livelihoods of many households who take dairy products as a major component of their food basket through food insecurity. Dairy contribution to the agricultural Gross Domestic Product (GDP) has significantly dwindled. In 2009, dairy contribution to agricultural GDP fell by 22% from 2.9 % in 2008 (Anseeuw *et al.* 2012: 27). The escalating natural disasters, complex and long supply chain have made it difficult to avoid supply chain risks. Government and private organisations are worried about the rising threat of supply chain disruptions caused by the increase in the number of hazardous events being experienced in the study country. It is against this background that this study seeks to assess the strategies by government and dairy companies which are currently in use to reduce disaster risks in the dairy industry.

1.3 Purpose of the Study

The purpose of this study is to investigate disaster risk reduction strategies that firms use to safeguard dairy supply chains from disruptions in Zimbabwe. The study also seeks to help government to develop disaster risk reduction legislation and policies to create incentives for the private sector to collaborate with dairy stakeholders.

1.4 Contribution of the study

This study contributes to the existing body of knowledge particularly to the field of disaster risk reduction in the dairy supply chain emphasising on collaboration. It is to the best of this researcher's knowledge that this is the first time an investigation has been carried out into the disaster risk reduction strategies in dairy supply chains in Southern Africa particularly in Zimbabwe. It is also envisaged that the outcome of this study will be an enabler in helping the government departments in the formulation of public policies for the dairy sector in managing and reducing disaster risks. The study is significant to the dairy supply chain stakeholders to improve their management of disaster risks in the dairy supply chain network. Proper implementation of the recommendations from this research will help improve access to high quality raw milk and milk products by consumers, resulting in improved nutrition and food security for the people of Zimbabwe.

1.5 Objectives of the Study

The objectives of this study are, *inter alia:*

- To explore the disaster risks that plague the Zimbabwe dairy supply chains,
- To explore the impact of disaster risk on dairy supply chains in Zimbabwe,
- To investigate collaboration strategies that are being implemented in Zimbabwe to reduce supply chain risks due to disasters,
- To determine the impact of private and public sector partnership efforts in disaster risk reduction on dairy supply chain performance in Zimbabwe,
- To establish factors that block disaster reduction efforts in dairy supply chains in Zimbabwe.

1.6 Research questions

This study seeks to answer the following research questions:

- Which disaster risks disrupt dairy supply chains in Zimbabwe?
- What is the impact of disaster risk on dairy supply chains in Zimbabwe?
- What collaboration strategies have been implemented to manage disaster risks in dairy supply chains in Zimbabwe?
- What is the impact of private and public sector collaboration efforts in disaster risk reduction on dairy supply chain performance in Zimbabwe?
- What are the forces against disaster reduction efforts in dairy supply chains in Zimbabwe?

1.7 Theoretical Framework

Based on the literature reviewed, this researcher used the collaborative framework as suggested by Shepard (2012: 8) focusing on sharing of information and working together by stakeholders to reduce risks. The collaborative function of Non-Governmental Organisations (NGOs) is stifled by unfriendly government policy. The Meteorological department of Zimbabwe lacks an integrated system which links disaster risk reduction institutions and the research centres (Agromet 2016: 5). This lack of coordination amongst all these stakeholders impedes proactive measures to be taken to reduce disasters in dairy supply chains in Zimbabwe. This framework takes a collaborative proactive approach to reduction of disaster risks in the supply chain. In this study, the partners include supply chain partners, government, and other service organisations. It is against this background that the study adapted the framework to bridge lack of collaboration among stakeholders in the dairy industry. As noted in the theoretical review, there are several frameworks proposed by various authors to manage supply chain risks. Of all the factors influencing the success of supply chain risk mitigation strategies, collaboration that includes supply chain partners and government received the least attention by researchers. There is also no empirical research that has been published that tests the collaboration framework.

1.8 Assumptions

This study was carried out under the following assumptions:

- That the respondents would cooperate and provide accurate information.
- That stakeholders would find this research meaningful and employ it to minimize and mitigate risks in dairy supply chains.
- That the Zimbabwean dairy farmers would not change their attitudes towards disaster risk reduction during the period of the study.

1.9 Limitations of the study

A study covering the whole of Zimbabwe could have provided an accurate picture about disaster risks in dairy supply chains, however, due to financial and time constraints, the study was delimited to the major milk producing areas of Chipinge, Mutare, Harare, Gweru and Bulawayo.

1.10 Scope of Study

The study focused mainly on the major milk producing cities/towns of Zimbabwe namely; Chipinge, Mutare, Harare, Gweru and Bulawayo. The study was delimited to a radius of 60 km around each of the cities /town. The majority of dairy farmers and processors are located in these regions. The geographical spread of the cities within the country allowed the generalizability of the research results to the rest of the country. This study assessed collaborative disaster risk reduction strategies in dairy supply chains. The study focused on collaborative strategies used in disaster risk reduction in dairy supply chains in Zimbabwe.

1.11 Definition of terms

Key terms used in this thesis are clarified below:

Collaboration: Refers to a “cooperative relationship built on developing synergies within and across company boundaries that help all supply chain partners” (Shepard 2012: 8).

Disaster: Disaster is a “serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources” (UNISDR 2009: 9).

Disaster risk: UNISDR (2009: 10) defines disaster risk as the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future period caused by a hazard due to the vulnerability within a community.

Supply chain: A supply chain is an integrated system in which various business entities such as suppliers, manufacturers, industrial customers, distributors and retailers work together to address issues of both materials flow and information flow (Subbaiah, Rao and Babu 2009: 1).

Supply chain collaboration: means “two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation” (Simatupang and Sridharan 2002: 25).

Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR 2009: 34).

1.12 Structure of the thesis

This section provides an outline of this thesis, which is split into six chapters and organised as follows:

Chapter 1: This chapter is the introduction to this study and serves as a guide. It provides background information, research questions, and objectives of the study and justification of the study. It also gives the assumptions, limitations and delimitations of the study.

Chapter 2: International perspective: This chapter reviews literature in the field of disaster risk management by examining the studies relating to prevalent risks in the supply chain network, strategies to mitigate risk and supply chain risk management frameworks. Such analysis reviews gaps from previous researches on disaster risk reduction and collaboration and thus gives direction to this research.

Chapter 3: The Zimbabwe Perspective: The focus of this chapter is to provide an overview of the risks (natural hazards, financial risks, political risks) plaguing the Zimbabwe dairy industry as well as mitigation strategies put in place by the government and stakeholders in the dairy industry. This chapter discusses the disaster legal frameworks in place, their history and how they support the dairy industry.

Chapter 4: Research Methodology: The purpose of this chapter is to discuss the research methodology employed in this study to gather data pertaining to this study. It covers such aspects as research design, sampling procedures, research instruments, data analysis and presentation procedures.

Chapter 5: Data presentation, analysis and discussion: This chapter presents data in the form of tables and graphs for information gathered through questionnaires. This researcher will discuss the information immediately below the graphs and tables. Qualitative data from observations and interviews will be reported in narrative episode. Study findings are discussed with the published literature reviewed in previous chapters.

Chapter 6: Summary, conclusions, recommendations, limitations of the study and recommendations for future researchers. This chapter concludes the research work.

1.13 Conclusion

The chapter gave an overview of the background of the study, its significance, the problem to be addressed, limitations of the study and the assumptions made. The objectives of this study were set out in respect of disaster risk reduction strategies in dairy supply chains in Zimbabwe. Chapter 2 reviews the literature on the current study.

Chapter 2

An international perspective

2.1 Introduction

This chapter explores the various literatures that previous researchers have put forward in relation to the area under study. The main purpose of this literature review is information gathering and critical appraisal to identify knowledge gaps in this study and areas that need improvement. The chapter discusses the conceptual framework of disaster risks. The chapter also discusses disaster risks found in developed and developing countries and thereafter the impact of such disaster risks on the supply chains of these countries. The study also reviewed literature on collaborative risk reduction strategies and supply chain performance in general and dairy supply chain in particular.

2.2 Disaster risks: a conceptual framework

This section articulates the major concepts that underpin this study from a relevance and applicability points of view. The terms disaster, disaster risk and hazard have often been confused and in some cases used interchangeably, yet these terms mean different things. This requires some scrutiny before proceeding with this review. In this section, this researcher distinguishes these terms.

According to UNISDR (2009: 20), a natural hazard is “a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage”. It is a source of interference in the supply chain (Murigi 2013: 971). Natural hazards have been causing bottlenecks over the past two decades and a reflection on the past natural disasters like the El Nino rains of 1997 and 1998 that caused massive flooding and damage in East Africa are testimony to that (Murigi 2013: 971).

A disaster can be defined as " a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" (UNISDR 2009: 9). The International Federation of Red Cross and Red Crescent Societies (n.d.) defines a disaster as a "calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources".

In the Zimbabwean context, Section 2 of The Civil Protection Act Chapter 10:06 interprets a disaster as:

(a) Natural disaster, major accident or other event howsoever caused; or

(b) Destruction, pollution or scarcity of essential supplies; or

(c) Disruption of essential services; or

(d) Influx of refugees; or

(e) Plague or epidemic of disease; that threatens the life or well-being of the community.

From the above definition, it can be deduced that a disaster constitutes an array of conditionalities that disturb the normal way of living of people of a certain locality or community. Disasters can be internal, within a certain locality where disturbances occur within a local context or external where the disturbances occur as a result of the outside influencer such as the influx of refugees from a neighbouring country.

The key phrases in the first two definitions are "exceeds the ability of affected community" and "outmanoeuvres the local effort hence necessitating for an external interference". This study will adopt the UNISDR definition as it covers a wide variety of disasters.

On the other hand, UNISDR (2009: 10) defines disaster risk as the potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future period caused by a hazard due to the vulnerability within a community. In the context of this research the UNISDR

definition of disaster risk will be adopted as it spells out a variety of ways disasters would impact on communities. It imperative therefore to look at models that define vulnerability in the community. The following section looks at models that explain how disasters arise in a community.

2.3 Vulnerability to disasters

According to the Pressure and Release (PAR) model: progression to vulnerability, natural hazards trigger disasters due to the vulnerability of communities to these natural hazards (Blaikie, Cannon, Davis and Wisner 2003: 50). A disaster occurs as a result of a combination of two opposing forces: those processes generating vulnerability on one side, and physical exposure to a hazard on the other (Blaikie *et al.* 2003: 50). In this view, this model has become the internationally acceptable model for the explanation of the progression of vulnerability and the progression to safety (risk reduction).

The model widely referred to as the Crunch Model (Blaikie *et al.* 2003: 50) indicates that there are certain underlying causes, dynamic pressures and unsafe conditions, which contribute to vulnerability of communities. The vulnerability context of dairy farming communities in this case is hinged upon the reduced capacities to protect themselves and their livestock from shocks emanating from the natural hazards such as floods, tornadoes among other natural disasters. There is increasing pressure on people arising from either side; from their vulnerability and from the impact (and severity) of the hazard on those people. These hazards interact with human activities, vulnerable property, people and livelihoods determining the magnitude of the disaster (Murigi 2013: 972). According to the Disaster Crunch Model, a disaster happens when and only when, a hazard impacts on a vulnerable community or people. In this view, the vulnerability of the people and property can take the form of fragile physical environment, fragile local economy, social relations or public action and institutions (Hai and Smyth 2012: 10-11). The level of disaster risk, therefore, depends on the magnitude of the hazard and degree of vulnerability of the people and property. The 1999 to 2009 drought of the Navajo Nation of USA turned into a disaster due to political

marginalisation and rural poverty for the Navajo people (Redster, Kelley, Francis and Block 2011: 10). Another example is the 1976 earthquake in Guatemala where slum dwellers in Guatemala City and many Mayan Indians living in impoverished towns and hamlets were the casualties (Blaikie *et al.* 2003: 9). Vulnerability to natural hazards can take any of the three dimensions: economic, physical or social (Concern 2005: 9). Economic vulnerability includes levels of savings, debt, and access to credit and insurance. Physical vulnerability include location and standards of infrastructure while social vulnerability includes lack of security, education levels, access to good governance, social equity, degree of respect for human rights, traditional values, knowledge, customs and whether one is a member or not a member of social organisations; ethnic, tribal, religious and political groupings (Concern 2005: 9). This study, therefore, seeks to fill the gap by linking Zimbabwe's dairy industry scenario to the Crunch model. Figure 2.1 illustrates the Pressure and Release (PAR) model: progression to vulnerability.

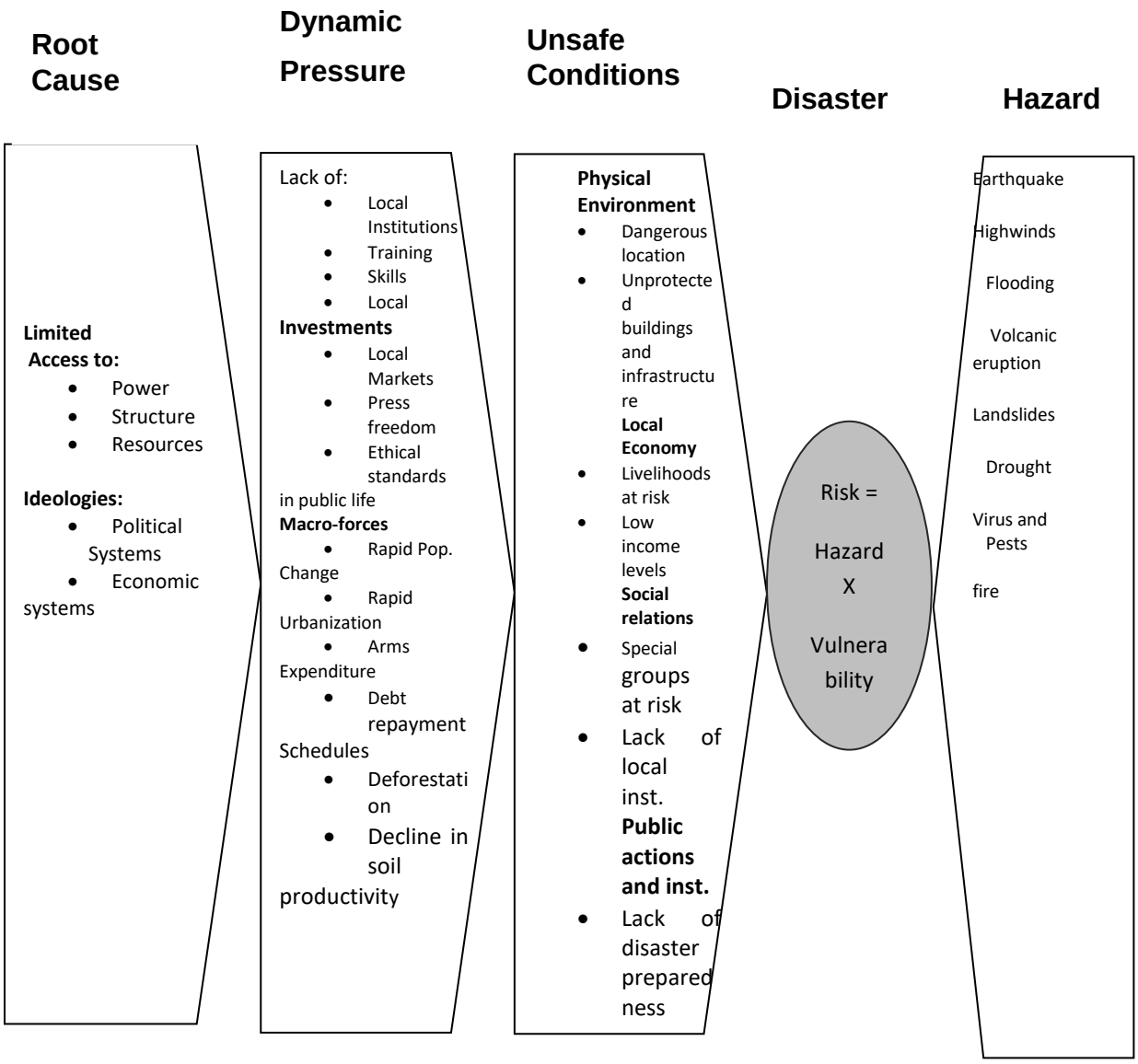

Figure 2:1 Pressure and Release (PAR) model: The progression of vulnerability

Source: *Blaikie, P., Cannon, T., Davis, I., and Wisner, B. 2003. At Risk: natural hazards, people's vulnerability and disasters. London: Routledge-Taylor and Francis*.

The model in Figure 2.1 suggests that the various natural hazards which may contribute to disasters in various communities include earthquakes, flooding, volcanic eruptions, droughts, viruses and pests. A disaster will be experienced when there is an interface between human activity and the hazard. It is important to realise that the severity of the

disaster depends on the level of unsafe conditions, dynamic pressures and the root causes. Mishra and Shekhar (2011: 1) indicate that the dairy food supply chain, which interfaces several stakeholders (farmers, National Association of Dairy Farmers, processors, Ministry of Agriculture, input suppliers, retailers) in the system, gets disrupted many times due to various vulnerabilities in the operation. The vulnerability context of this industry is hinged upon the realisation that risk and uncertainties get multiplied with the perishability nature of the raw material (milk) which the industry relies on. Shamsuddoha, Roberts, Hasemann and Roddick (2013: 24); outline that with respect to disaster risk reduction, efforts should adopt long-term focus to ensure resilience. Instead, long-term DRR funding mechanisms should be developed to enable greater cooperation and coordination between humanitarian and development actors. In this regard resilience to shocks from natural disasters such as excessive droughts, volcanoes, earthquakes among others emanates from strong institutional arrangements and disaster preparedness mechanisms in order to minimise the impacts of disasters in major economic sectors including the agriculture sector in general, and dairy farming in particular, due to the perishability of the raw milk.

Similarly, Guzman (2003: 7) asserts that when assessing the vulnerabilities and risks of communities, assessment should be undertaken in the broader socio-cultural, economic, environmental and political contexts. Guzman (2003: 9) emphasises that in pursuit of a holistic approach to disaster reduction, it is important that sectors are aware of prevalent risks, the prevailing vulnerabilities, and the methods to assess them.

Deducing from the Pressure and Release (PAR) model, reducing risks in communities is achieved through addressing a significant number of development and socio-political issues (Van Niekerk 2011: 22). Figure 2.2 shows the release of ‘’pressure’’ to reduce disaster progression to safety.

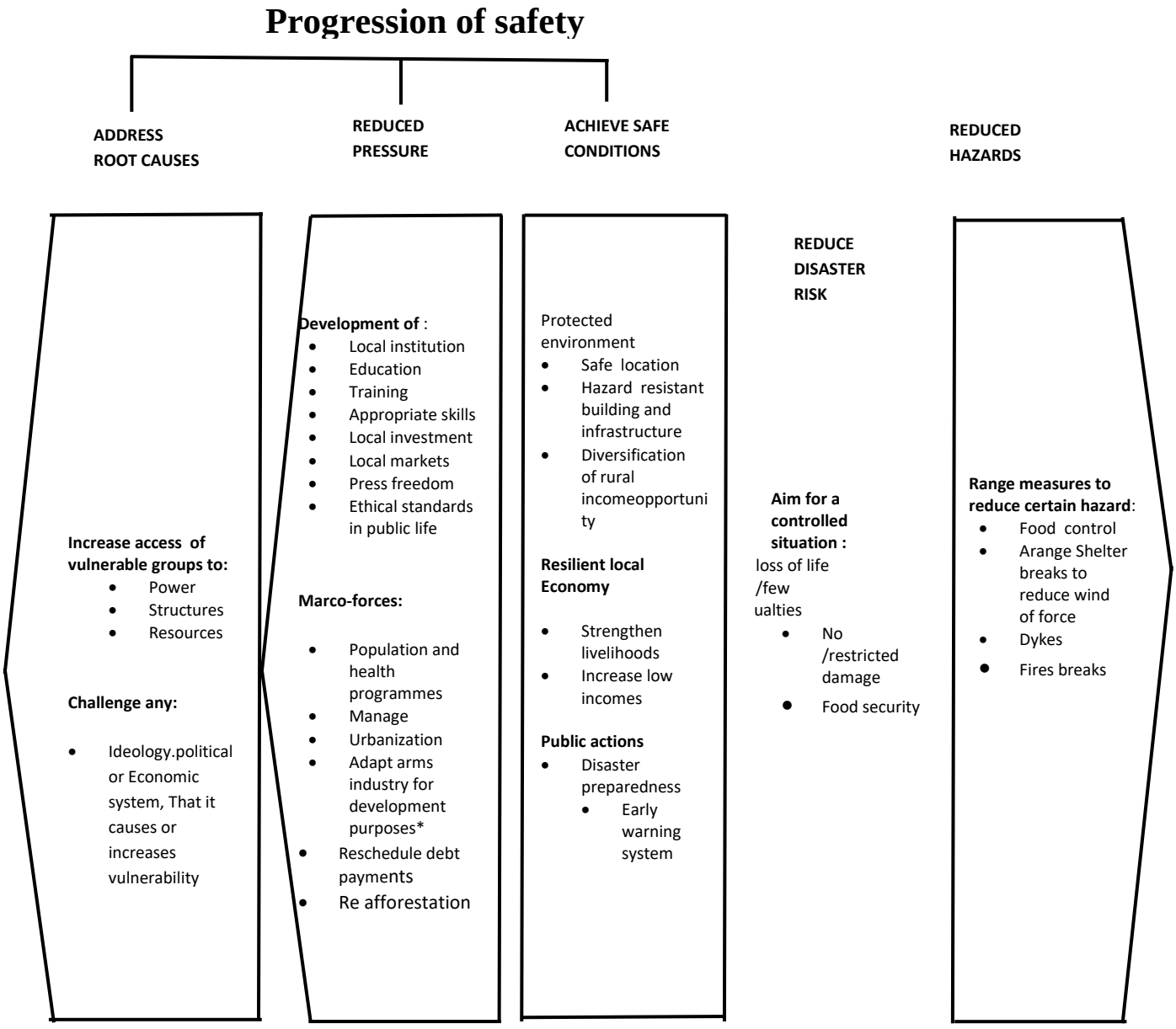

Figure 2:2: The release of "pressures" to reduce disaster: progression to Safety

Source: Blaikie, P., Cannon, T., Davis, I., and Wisner, B. 2003. *At Risk: natural hazards, people's vulnerability and disasters.* London: Routledge-Taylor and Francis.

The Release Model, Figure 2.2, is the reverse of the crunch model and against all the components of the Crunch Model to reduce risk of disaster. It indicates how conditions need to change to reduce vulnerability (Blaikie *et al.* 2003: 50). Ideally the pressure between hazards and vulnerability should be released to reduce disaster risk. The Release Model aims at reducing vulnerability at different levels of the Crunch Model: “unsafe conditions” must be turned into “safer conditions”, “dynamic pressures” will be reduced and “root causes” will be addressed (Hai and Smyth 2012: 12).

This discussion on vulnerability to disasters has underlined the need to consider different disasters that strike various parts of the world. Without clarity on disaster risks that communities are exposed to, it is difficult to recommend intervention strategies to reduce such risks. These disasters will now be discussed in relation to developed and developing countries, in the following section.

2.4 Disasters in developed and developing countries

Developing and developed countries face new and emerging hazards that may magnify disaster risks (UNISDR and PricewaterhouseCoopers 2013: 6). Natural disasters can take various forms. Disasters can be due to earthquakes, floods, tsunamis, drought, volcanic eruptions, wild fires, heat waves, lightning, thunderstorms, landslides, crop pests and epidemics. These disasters vary from one region to another and from one country to the other. The Middle East is vulnerable to, and experiences floods, earthquakes, storms and droughts are the most frequent causes of disasters (The World Bank 2014: 6). Drought has been a persistent feature in most parts of Southern Africa, Central and South-West Asia (UNISDR 2004: 50-51), and some parts of North and West Africa including Ethiopia, Somalia, Eritrea, Sudan and Niger (Concern 2005: 2). On the other hand volcanoes with high levels of activity are located predominantly in developing countries, particularly in Haiti, DRC, Afghanistan, Indonesia, Bangladesh (Concern 2005: 2), Latin America, the Caribbean, and parts of Asia and in the South-West Pacific (UNISDR 2004: 54).

Bangladesh, India, Haiti, Sri Lanka are prone to tropical storms while, Cambodia, Mozambique, Ethiopia, Somalia, Pakistan, Bangladesh and India are the countries that are often affected by floods (Concern 2005: 2). Moreover, some countries in East Africa (Kenya, Rwanda, Burundi, Tanzania and Uganda) are prone to natural hazards such as floods, droughts, earthquakes, landslides, strong winds, lightning and their secondary impacts of diseases and epidemics (East African Community 2012: 10).

Similarly, Australia has not been spared by these disaster risks. Kimura and Antony (2011: 8) have noted that there are various agricultural risks that have been identified in the Australian agriculture framework. These risks include natural disasters such as floods and bushfires, animal or plant disease outbreaks, and hail and frost risk. For dry land farmers, weather and yield risks are foremost in their planning while many other risks are significant but secondary. In addition, another distinguishing feature of risks in Australia is that the disaster risks that are experienced in Australia are systemic which implies there is general correlation across the various farming regions. This development has been attributed to the catastrophic nature of the risks that are experienced in Australia which has wide geographical coverage. Kimura and Antony (2011:19) have noted that natural disasters that particularly caused serious damage in the history of Australia include: Tropical Cyclone Mahina (1899), Black Friday bushfires (1939), Floods in New South Wales (1955), Black Tuesday bushfires (1967), tropical cyclone Tracy Darwin (1974) among other natural disasters. The above-mentioned array of natural disasters has a direct impact in agricultural productivity among other economic facets of the above mentioned countries and dairy farming and production is no exception.

Likewise, Kenya and Ethiopia have their own share of disasters. Kenya and Ethiopia host 492,046 and 240,086 Somali refugees, respectively (European Resettlement Network 2013: 3). The majority of these refugees fled following the 1991 collapse of the Somali government and the ensuing civil war and humanitarian crisis. In 2011, Somali refugee arrivals into Kenya and Ethiopia increased significantly due to the combined effects of drought, famine and ongoing insecurity in Somalia. Though the above cited

example has been human induced it can be seen that this results in the strain of agricultural productivity including dairy farming. Roncoli, Okoba, Gathaara, Ngugi and Nganga (2010: 8) note that the research village of Alango Arba, located on the route to Somalia, plied by foreign aid vehicles and *miraa* traders leading to the large Somali refugee camp of Dadaab, which hosts about 170,000 residents. Relations between the refugees and the local population are tense, exacerbated by drought-induced scarcity of natural resources and pastureland resulting in negative performance of dairy production.

South Africa, one of the biggest economies of Africa, is also prone to disasters such as devastating floods, violent hailstorms, heavy snowfalls and gale-force winds. In 2008 South Africa was hit by floods in the areas of KwaZulu-Natal and Western Cape. It is predicted that the incidence of major 'wet' events, such as floods and cyclones will increase in frequency against the backdrop of changing climatic conditions (Chagutah 2009: 113). In this view climate change seems to have a direct effect on the manner in which production is undertaken in general, and the performance of agricultural production in particular. As has been noted in preceding paragraphs, disasters in developing and developed countries vary from country to country. Where disaster risks are prevalent in more than one country, their frequency and intensity vary from one country to the other. This research, therefore, seeks to establish the nature of disasters that are prevalent in Zimbabwe. These disasters may also affect the supply chain.

2.5 The concept of supply chain

A supply chain refers to all the stages involved, directly or indirectly, in fulfilling a customer request. Subbaiah *et al.* (2009: 1), define a supply chain as an integrated system in which various business entities such as suppliers, manufacturers, industrial customers, distributors and retailers work together to address issues of both material flow and information flow. The supply chain is composed of an array of activities including procurement of materials from suppliers, transportation of materials to facilities, production of goods at facilities, transportation of goods from facilities to

warehouses and transportation of goods from warehouses to customers. Chopra and Meindl (2004: 12) indicate that a supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. In addition, Kemokai (2012: 32) argues that dairy supply chain relationships in Kenya not only include the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. In essence, supply chain activities begin with a customer demand and end when a satisfied customer has paid for his or her purchase. Kemokai (2012: 42) outlines that the term supply chain conjures up images of product or supply moving from suppliers to manufacturers to distributors, retailers and customers along a supply chain. It is, therefore, important to visualize information, funds, and product flows along both directions of the chain. Martin (1998: [8]) recognises that one of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. Kemokai (2012: 33) concurs with Martin (1998: [4]) by propounding that in the modern competitive business environment the ultimate success of the business will depend on management's ability to integrate the company's business network to sustainable and reliable levels. Organisations are reliant upon having effective supply chains, or networks, to successfully compete in the global market economy (Naslund and Williamson 2010: 11). Businesses rely on the supply chain for survival through the flow of information, goods and funds between different stages of the supply chain (Chopra and Meindl 2007: 3). This study thus aims to shed light on the natural disaster risks that affect stakeholders in the dairy supply chain in Zimbabwe. In the next section, the researcher looks at the impact of disasters on the supply chain of both developing and developed countries.

2.6 Impact of disasters on supply chains in developed and developing countries

There has been an increase in the number and impact of natural disasters in recent years leading to massive loss of life and negative social, economic and environmental consequences for vulnerable communities. Economic globalisation also reshapes

exposure and vulnerability patterns, both risks and losses could surge and are transmitted through value and supply chains, meaning that even economies not directly exposed to hazards can be at risk (UNISDR 2013: 271). In this regard, supply chain disruptions caused by external events can have a significant financial and operational impact on firms not properly prepared. A myriad of natural disaster risks can cause disruptions to supply chains as production nodes and communication networks break down and these include droughts, floods, tsunamis, volcanic eruptions among other natural disaster risks. Different natural disasters affect the various countries in different ways. A disruption in one region of the world affects the world through the supply chain networks. When a disaster hits a firm, the disruption that results can ripple through national, regional and global supply chains, causing direct and indirect losses in related industries (UNISDR 2013: 30). Different countries (developed and developing) have been directly affected by both manmade and natural disasters:

Japan and Thailand

The 2011 Great East Japan Earthquake and 2011 Thai flood caused disruption to production networks and supply chains that extended to other countries in the region due to interdependencies of regional and world economies (Asian Development Bank and Asian Development Bank Institute 2013: 9). The USA production growth dropped from 15.6 % in the first quarter of 2011 to 2.1 % in the second quarter due to the reliance of USA automobile manufacturers on Japanese parts (UNSDR 2013: 43). Thailand's supply chain disruption and production losses, due to the 2011 floods, affected Japan's manufacturing production due to economic interdependences between Thailand and Japan (Ye and Abe 2012). The financial costs of these disasters were estimated as follows, the Thai floods US$2.2 billion and The 2011 Great East Japan Earthquake US$235 billion, making it the most costly natural disaster in the world (Asian Development Bank and Asian Development Bank Institute 2013: 9).

USA and China

Hurricane Katrina that hit the Gulf Coast resulted in disruption to the supply chains that affected many organisations in the United States and across the globe. It interrupted

USA's stocks of green coffee beans that were held at the Port of New Orleans and London Metal Exchange's reserves of zinc which were housed there (Marsh 2005: 5-6). FM Global (2014: 4) notes that companies that have significant investments and dependence on supply chain in China fear that natural disaster related supply chain disruption in China would make them incur far reaching negative consequences. For instance, supply chain disruption in China will slow down the world's economic growth, as China is a major exporter as well as importer of world goods/services.

Bangladesh

Dairy supply chain in Bangladesh is affected by, among other risks, natural risks which include flood, storm, drought, too much humidity, and heavy rainfall, pollution and unhygienic environment, and quick perishability nature of milk (ANZAM 2014: 13). This has resulted in devastating loss to all members within the dairy supply chain network.

Mozambique

According to Disaster Risk Financing and Insurance Program (DRFIP) and Global Facility for Disaster Reduction and Recovery (GFFDRR) (2012: 10) the impact of disaster events in Mozambique have affected agricultural supply chains. Producers have trouble in storage, processing, marketing and transporting surpluses in good years, preventing Mozambique from smoothing production volatility across the country. The poor state of the road network and high transport costs hinder the movement of surpluses between the surplus producing regions in the north and the south where the risk of production deficits is highest. The UN World Food Programme estimates a deficit in cereals of 500,000 metric tons per year. Additionally, it is predicted that due to climate change; flood peaks in the Limpopo and Save rivers will increase and temperatures will increase impacting on sectors like agriculture, infrastructure, power, water and sanitation, health, and nutrition (Schmuck 2013: 4).

Uganda

The World Bank (2011: 1) had an assessment of the Ugandan dairy industry to identify and analyse the risks in the Ugandan dairy supply chain. Key dairy industry stakeholders were interviewed and secondary data on the dairy sector reviewed. The

identified risks were put in three main categories of production, market, and enabling environment risks. The assessment revealed that Uganda is faced with multiple risks that included cattle diseases, drought, floods, milk spoilage, armed conflicts, cattle rustling, abrupt regulations, erratic power supply and human disease. From the assessment, it was concluded that the major risks, by virtue of their potential to cause the greatest losses and the high frequency of their occurrence, were cattle diseases, drought, abrupt regulations, and failure of key organizations impact on the entire supply chain (The World Bank 2011: 11). This development, in essence, implies that milk production is adversely affected by the prevalence of such risk factors as they can cause substantial volatility in milk production thereby leading to financial losses to the cattle farmers and the entire industry. According to the The World Bank (2011: 14), though Uganda has abundant water resources, its distribution is uneven and a large number of pastoral milk producers live in the semi-arid areas depending on lakes, ponds and dams for human consumption and livestock production. According to The World Bank (2011: 15) as a consequence of the increased frequency and severity of drought, milk production is undermined because of the lack of water and natural pastures. In the same vein, Government of Uganda (2002) concurs that the severe drought experienced, mostly in the cattle corridor during La Nina of 1998-1999 affected over 3.5 million people in 28 districts. Erratic power supply causes significant problems to the dairy supply chain, leading to long equipment breakdown time, idle capacity utilization, low-capacity utilization and high costs to supplement electricity (The World Bank 2011: 15).

Kenya

Furthermore Murigi (2013: 972) articulates that natural disasters in Kenya include drought, floods earthquakes, volcanic eruptions, storm diseases and pest infestations. Kenya experiences long dry periods leading to a shortfall of milk during the months of January to April 20 (Valk 2008: 20). A drought that occurred from 2008 to 2011 in Kenya impacted directly on livestock and agriculture resulting in increased costs of production leading to a decline in economic growth and inflation (Government of Kenya 2012: 40). In this regard, Murigi (2013: 972) further concurs that the 1999-2001 drought saw a 40%

drop in hydropower generation which led to recurrent energy rationing consequently resulting in supply chain disruptions in many industries including dairy farming. In relation to the above, El Nino floods resulted in the busting of river banks resulting in the destruction of bridges, property damaged, affecting an estimated 1.5 million Kenyans (Ngecu and Mathu 1999: 277-284).

Ghana

Contrary to the above, Yeboah, Feng, Daniel and Joseph (2014: 39) in their study on agricultural supply chain risk identification in Ghana, indicate that the agricultural supply chain in Ghana is not influenced by extreme cold, hail storms, strong winds, earthquakes which influence the supply chain in other parts of the globe. It was also realised that flooding agricultural supply in Ghana seldom occurs. Natural disasters consist of a hodgepodge of natural phenomena some of which are climate related and some which are environmentally and biologically inclined. In this regard, it can be noticed that these natural disasters caused havoc in the various economic sectors of the country including agricultural production. Moreover, the Australian Government (2005: 12) outlines that agricultural activities; because they generally have a larger environmental component, are different from production systems elsewhere in the economy. Many of these physical and biological factors, such as variations in rainfall and the onset of disease, are largely outside the control of farmers, yet they can have a significant effect on the level of production, input use, prices and the performance of farms including dairy production.

India

Mishra and Shekhar (2011: 1) in their study of Indian dairy industry collected data from 1,063 respondents from the dairy supply chain to ascertain the operational risks in the dairy industry. Though they identified 15 risks, eight risks were found to be critical in Indian dairy industry. The eight risks were identified as non-remunerative price of milk, illiteracy of milk producers, lower level of milk procurement, logistical risks, hazard risks, demand unpredictability and lack of product reliability (Mishra and Shekhar 2011:15). Fire was singled out as the disaster risk that hampers Indian dairy business activities

most (Mishra and Shekhar 2011: 15). Conversely, Ghosh, Sindhu, Panghal and Bhayana (2014: 9-10) confirm that the majority of the Indian dairy farmers and processors face many types of risks such as financial risks, compliance risks, market risks or climatic risks such as adverse weather conditions.

The devastations caused by the disasters in the various countries highlights the need for increased commitment and investment in disaster risk reduction. This study questioned how public and private organisations reduce these natural disasters? Instead of studying the whole disaster risk management cycle, this study focused on disaster risk reduction. However, the following sections introduce disaster risk management first before discussing disaster risk reduction.

2.7 Disaster risk management

Disasters occur due to the interactions of natural hazards with vulnerable property, people, and livelihoods. The vulnerability of the people, property or installations defines the magnitude of the disaster. In this view, UNISDR (2009: 10) defines disaster risk management as ‘the systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. Its aim is to implement activities and measures for prevention, mitigation and preparedness. Figure 2.3 shows a typical disaster management cycle depicting its various stages.

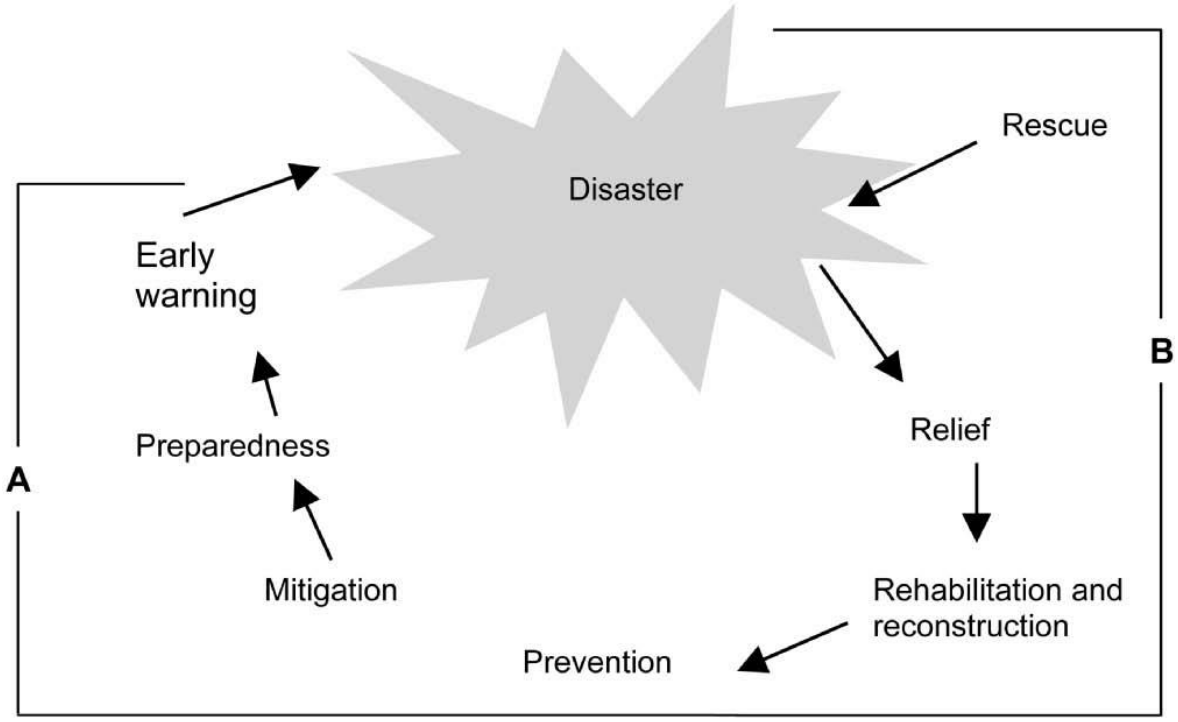

Figure 2:3 Disaster management cycle

Source*: Vermaak, J., and Van Niekerk, D. 2004. Development Debate and Practice: Disaster risk reduction initiatives in South Africa. Development Southern Africa, Vol. 21(3): 556- 559.*

The problem with this disaster management cycle is that most stakeholders have concentrated on reconstruction and relief, which are post disaster activities. They ignore the causes of these disasters such as risk, hazards and vulnerability in most cases yet there is a move away from relief to disaster risk reduction (Vermaak and Van Niekerk 2004: 557). The next section discusses the concept of disaster risk reduction.

2.8 Disaster risk reduction

According to UNISDR (2009: 10), disaster risk reduction can be defined as;

> *the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise*

management of land and the environment, and improved preparedness for adverse events.

In concurring with the UNISDR definition above, the South African Government (2005: 2) through the South African National Disaster Management Framework (SANDMF) views disaster risk reduction (DRR) as "all the elements that are necessary to minimise vulnerabilities and disaster risks throughout society." It includes the core risk reduction principles of prevention, mitigation and preparedness.

The key phrases in the above definitions are reducing disaster risks and minimising vulnerabilities. What is clear from the DRR definitions by UNISDR and SANDMF is that DRR is limited to those concepts and practices that are specifically targeted at prevention or mitigation and preparedness for the adverse impacts of hazards which are in the pre-disaster phase of the disaster risk management cycle in Figure 3 above. These measures reduce vulnerability to natural hazards.

Concern (2005: 10) outlines that DRR is a means of bridging the gap between development and humanitarian programmes and can be seen as a means of strengthening livelihood security. In countries faced with recurrent crises, development can only be sustained if there is a proper understanding of, and response to the negative impact of disasters. DRR interventions seek to assist in the development of this understanding, to support livelihoods and to protect assets. In this view, the fortification of these community assets includes livestock that forms part of dairy production. It is hoped that DRR interventions will reduce communities' vulnerability and increase their opportunities of pursuing sustainable livelihoods.

Disaster risk reduction therefore implies addressing vulnerabilities, including root causes and dynamic pressures, and aims at building economic, physical and social capacities. Disaster risk reduction represents a move from a traditional approach of reacting and responding to disaster to a focus on prevention of disasters (Vemaak and Van Niekerk 2004: 556). The devastation caused by Hurricane Katrina shows that

traditional plans and policies of reducing disaster risk are inadequate. DRR activities should be undertaken at all stages of the disaster management cycle as follows: pre-disaster, disaster response and post-disaster recovery (Hansford, Dellor and MacPherson 2007: 7). Disaster risk reduction also gets justification even from the Holy Bible (Hansford *et al.* 2007: 5). In the Genesis flood (Gen. 6-8), Noah saves his family and many land animals and birds by constructing an ark. From Genesis 41 and 47:13-26, Joseph interprets Pharaoh's dream and was entrusted with a nation-wide famine preparedness programme. Joseph saved Egypt and his own wider family from Canaan, from starvation throughout the seven years of bad harvest.

UNISDR (2004: 5) gives examples of early risk reduction in societies. More than 1,000 years ago, the Chinese constructed protective dykes in anticipation of the annual flooding of the Yangtze River and other major rivers. The Incas of the Andes built terraces on steep slopes, between the 13th and 15th centuries, to conserve the scarce soil and water necessary for their crops. In Vietnam, villagers have over centuries cleaned, repaired and strengthened their crucial irrigation channels and sea dykes before the start of every annual cyclone season. This can be recognised as a necessary precaution to ensure the continued cultivation of rice.

The 1990s were declared the 'decade for disaster risk reduction' by the UN due to the increasing concern for the impact of natural disasters. The International Strategy for Disaster Reduction (ISDR) was the UN body now responsible for promoting DRR for member governments and organisations. The ISDR was founded in 2000 to continue to promote work and commitment in disaster reduction. Its focus had shifted the primary focus from hazards and their physical consequences to emphasize more on the processes involved in incorporating physical and socio-economic dimensions of vulnerability into the wider understanding, assessment and management of disaster risks. This highlights the integration of disaster risk reduction into the broader context of sustainable development and related environmental considerations (UNISDR 2004: 11). ISDR's objective was to reduce human, social, economic and environmental losses due to natural hazards through building disaster resilient communities by promoting

increased awareness of the importance of disaster reduction as an integral component of sustainable development.

Likewise China established the Chinese National Committee for International Disaster Reduction (CNCIDR), showing signs of interest in the importance of disaster reduction activities. CNCIDR was responsible for designing a national disaster reduction framework. This followed the launch of ISDR in October 2000 (UNISDR 2004: 87). To show commitment in the implementation of a national strategy for disaster reduction the Chinese government launched the National Disaster Reduction Plan for the People‘s Republic of China (NDRP) (1998-2010). The World Bank has also shifted its investments from natural disaster reconstruction operations and is now paying more attention to the need to mitigate the effects of natural disasters before they strike. The bank lends money to countries for mitigation and prevention projects to help reduce demand for reconstruction and relief (UNISDR 2004: 350).

In the same way, South Africa has taken up disaster reduction initiatives. South Africa has been leading in Africa with regards to disaster reduction. It was the first African country to pass disaster risk management pieces of legislation (Disaster Management Act of 2002) (Van Niekerk 2014: 858). The Disaster Management Act of 2002 (DMA) calls for the development of an integrated and coordinated policy for disaster risk reduction, in which the main emphasis is on disaster risk reduction and certain aspects of post-disaster recovery. The DMA culminated into the birth of the national disaster management policy framework of 2005. The National Urban Search and Rescue (USAR) framework of South Africa intended to provide a single framework and enabling environment for national management disaster centre, provincial and municipal centres, other government departments and stakeholders to address challenges with previous frameworks (Government of South Africa 2014: 5). There was no national USAR framework before and USAR capacity remained inadequate and was largely volunteer based, which was not in line with disaster management framework of the Republic of South Africa.

Ethiopia transformed its disaster management from post disaster response, recovery and rehabilitation to pre-disaster preparedness and prevention measures (Abebe 2009: 60). This was done through the promulgation of the National Prevention and Preparedness Strategy in 1990 and Disaster Prevention and Management policy in 1993. Similarly, Ethiopia suffered a series of disasters (drought induced famine, flood, landslide, crop pests, earth quake and wars) that caused deaths and destruction to millions of dollars' worth of property. However, there is little attention paid to partnership and collaborative relationship among the stakeholders in disaster management. The other important event that marked a paradigm shift in the field of disaster management in Ethiopia was the proclamation of the Disaster Prevention and Preparedness Commission (DPPC), a legal framework for modern disaster management hinged on prevention and risk reduction strategies.

International agreements such as the Hyogo Framework for Action 2005-2015 emphasise the importance of disaster risk reduction. The Hyogo Framework for Action adopted at the World Conference on Disaster Reduction, held in Kobe, Hyogo, Japan, 18-22 January 2005 took a global approach to reducing vulnerabilities to natural hazards, by reducing the underlining risk factors to ensure disaster risk reduction (DRR). Collaboration and cooperation are at the heart of the Hyogo Framework for action. Uganda has implemented the priorities of the Hyogo Framework of Action (HFA) through the revised national disaster risk reduction and management and preparedness policy of 2007. The policy will be implemented by all government ministries in collaboration with humanitarian and development partners, the private sector, local government and community (Republic of Uganda 2008: 24).

Other literature has suggested theories to reduce disaster risk in supply chains. Chopra and Sodhi (2004: 87) proposed a two-step framework to create a shared view and organisation wide understanding of supply chain risk and adapt general risk mitigation approaches to specific company situations. In the framework teams stress test their supply chains by performing 'what if' scenarios and tailor risk management approaches to scenarios in their organisation. Silva and Reddy (2011: 87) concur with Chopra and

Sodhi (2004: 56) on the above two steps but, however, propose three more core competencies in their risk management framework, to make the supply chain more resilient. Silva and Reddy (2011: 112)'s core competencies include top management commitment, stress testing, tailoring risk management approach to the needs of the organisation, testing your disaster risk management plan and finally measuring it.

In spite of the prevalent problem, where there are escalating disaster risks, the focus should shift to disaster risk reduction. It is not possible to attain the goal of sustainable development unless there is a shift from relying on reconstruction and relief after a disaster has struck to disaster reduction. One strategy to reduce disaster risk is collaboration of stakeholders. Literature reviewed suggests a collaborative approach for management of disaster risk reduction where supply chain partners collaborate to improve access to information from the trading network and visibility into sources of risk in the supply chain. This study, therefore, seeks to fill the gap by examining the disaster risk reduction strategies in the dairy supply chain in Zimbabwe.

2.9 Collaboration strategies and disaster risks

Collaborative efforts are essential in managing disaster situations. Collaboration between the state and non-state actors can implement various strategies in order to manage disaster risks. In Bangladesh the National Plan for Disaster Management, 2010-2015 of Bangladesh illustrates the need for disaster reduction through a multi-sectoral approach involving the collaboration of government ministries, NGOs, civil society and private sector (Government of the People's Republic of Bangladesh 2010: 13). As International Strategy for Disaster Reduction (ISDR) and United Nations Development Programme (UNDP) (2010: 15) observes in El Salvador that collaboration between international and national NGOs can leverage donor resources more effectively. Collaboration among NGOs also helps form unified conceptual approaches and results in a better exchange of ideas, experiences and methods. According to ISDR and UNDP (2010: 15) the adoption of an integrated Local Level Risk Management Approach (LLRM) in Fiji was meant to reduce risks associated with flooding in the flood

prone area. Disaster risk reduction at the local level is more likely to be sustainable when projects start by addressing local development issues, and integrating risk management into existing development initiatives. In addition ISDR and UNDP (2010: 15) outlines that the LLRM supports communities to manage and reduce disaster risk as well as foresee and control the emergence of new risks. This is done through work on local governance, and community planning and preparedness, as well as through individual participation and motivation.

In the same manner, the Total Disaster Risk Management Approach (TDRM) introduced in the Asian and Pacific areas was viewed as a panacea to disaster risks through holistic, collaborative, participatory and proactive approaches (Guzman 2003: 14). The emphasis of this approach is the focus on disaster risks and vulnerability whilst adopting multi-level and multi-dimensional and coordination and collaboration amongst all stakeholders in addressing existing gaps in the disaster management cycles. McKeon (2014: 4) in the National Farmers Federation submission to the Productivity Commission Inquiry argues that, even though under the Australian constitution most natural disaster mitigation, resilience and recovery activities are the responsibility of the state and territory governments, it is also the responsibility of the Commonwealth to collaborate and coordinate responses and supporting development through state and territory governments in order to mitigate disaster risks. In contrast Bachev and Nanseki (2008: 22) explain that in Bulgaria, in the post-communist era, diverse risks associated with the dairy farming were not effectively governed and persist during transition now. In this view there was ineffective public (government, international assistance) intervention to correct market and private sector failures in the risk governance.

AsKirton (2013: 4) articulates in the Caribbean Communities (CARICOM), governments have also recognised that it is critical for them to cooperate and enhance regional institutional capacity in areas such as disaster risk management in order to collaborate meaningfully with global institutions and states. In this view, a 1973 Treaty placed particular emphasis on the need for collaboration and functional cooperation in disaster risk management, establishing it as one of the key pillars of the integration movement.

Article 6 (i) of the 2001 revised Treaty of *Chaguaramas* identified enhanced functional cooperation as one of the fundamental objectives of CARICOM and sought to raise the levels of cooperation (Kirton 2013: 4). The major impetus behind this collaboration was the realisation that the region has been marred with numerous natural disasters and there was need for collaborative efforts in order to minimise the impact of the various natural disasters. There was the formation of the Caribbean Disaster Emergency Response Agency (CDERA) which was charged with coordination of disaster amongst countries. CDERA's principal functions were to mobilize and coordinate disaster relief from governmental and non-governmental organisations (NGO) on behalf of member states. These collaborative initiatives were aimed at creating a strong institutional framework to ensure there is preparedness amongst countries in disaster situations. In concurrence Ferris, Petz and Stark (2013: 8) argue that organisations holding regular discussions have generally developed broader cooperation on DRM than those that have only had once-off meetings. CDERA has engaged in frequent, multi-stakeholder discussions involving governments, private sector agencies, NGOs and civil society groups (Kirton 2013: 7). In this regard, it can be noticed that a multi stakeholder approach is critical in organising efforts as well as having a diverse range of alternatives operating under one ambit hence strengthening the institutional and financial capacities of the various countries in disaster risk reduction.

In contrast, ISDR (2014: 18) notes that most governments have not fully developed coordinated and coherent action on disaster risk reduction across different sectors and between central and local governments. In this regard, it can be noted that institutional arrangements, legislation and policy for disaster risk reduction tend to be anchored when it is available in institutions that do not have authority to make decisions in cases where disaster struck. Interestingly, though there is a growing recognition about government's responsibility for effective disaster risk reduction policy planning and implementation conducted through a transparent and multi-stakeholder approach goes a long way in ensuring sustainable disaster risk management particularly in the agricultural sector. As the International Decade for Natural Disaster Reduction (IDNDR) (1990-1999) outlines that for cooperation between the government, civil society regional

institutions and international institutions to be successful there are guidelines that need to be followed including obtaining political commitment from public authorities, increasing public awareness, fostering better understanding and knowledge of the causes of disasters, stimulating interdisciplinary and inter-sectoral partnerships. These guidelines oversee the manner in which the various institutions conduct themselves in disaster planning and mitigation measures.

The Indonesian government has also embraced the multi-sector, multi-level and multi-based approach (ISDR and UNDP 2010: 21). In this regard Indonesia's administrative system is uniquely organised and categorized from top to bottom, right down to formally recognised neighbourhoods of 60-100 households. These mechanisms for well-organised participatory involvement, coordination and monitoring at local levels involve a multi-stakeholder approach with all the key strategic stakeholders in order to champion robust disaster reduction mechanisms. ISDR and UNDP (2010: 21) have reiterated that good coordination, commitment and active participation of multi-level stakeholders from government level to community level is a key factor for programme success. Furthermore, support for collaboration in Indonesia come in the form of Merapi Forum which is a multi-stakeholder forum to address the hazard of volcanic eruption in the area (ISDR and UNDP 2010: 27). The major goal of the forum is to foster collaboration among the people living around the Merapi slopes including stakeholders such as the government, donors, the media and the private sector. There have been tangible outcomes that have been realised as a result of the collaborative efforts amongst the stakeholders including capacity building of local farming communities and local governments and fostering mutual understanding amongst the various stakeholders (ISDR and UNDP 2010: 28).

Tabar-Cleofe (2010: 18) argues that Corporate Network for Disaster Response (CNDR) was established after the 1990 Luzon Earthquake which occurred during a USAID meeting, where participants were trapped in the collapsed buildings. Companies with helicopters, drills and mobile phones lent these to the rescue teams. They recognised that they had resources that were not available to the government and that there was a

need for a formal coordinating mechanism amongst the companies and government agencies that were responding to a disaster. In contrast to the above, Forbes (2010: 13) points out that there are insufficient opportunities for the private sector to interact with and discuss disaster management issues with the public sector. In this regard, it can be seen that private sector is insufficiently involved in discussions and not enough opportunities are provided for the private sector to interact with the public sector on disaster management. The basic needs in a post-disaster situation are identified resources and services that could be provided by the government agencies, the private sector and NGOs. In this view the explanation of the different approaches to incident management and the different priorities of government agencies and the private sector in the aftermath of a disaster. In doing so, Forbes (2010: 13) suggests that the main role of the government should not only be to legislate, but to provide an enabling environment and support framework through which the other contributors can respond.

In the same vein, Timeteo (2010: 22) in the Philippines context outlined that private sector involvement in DRM has focused largely on relief and recovery initiatives and there was a need to extend the scope of their engagement to include DRR activities. In this view, private sector DRM contributions also serve their business interests, and the government should play a role in promoting innovative engagement of the private sector in DRM and recognising the resulting initiatives. In this view, it is important to note that the bedrock of the successful private-public partnership engagement rests with both local and central government. This scenario calls for the governments to be more proactive in the provision of an enabling environment for the thriving of an effective partnership between the state and the private sector in disaster risk management.

Forbes (2010: 14) bemoans that not enough of the private sector is involved in discussions and not enough opportunities are provided for the private sector to interact with the public sector on disaster management. In this view, it seems that the oversight role of the government is often misused, misplaced and overdone at the peril of the active and sustainable participation of the non-state actors (private sector and civil society). Guzman (2003: 11) concurs that with the immensity and complexity of the

disaster problem no one stakeholder could effectively address the problem alone. Cooperation in disaster risk reduction activities among governments both local and national, NGOs and the various sectors of the economy is essential (Guzman 2003: 11). A multi-stakeholder and participatory approach is important in ensuring that total disaster management is undertaken taking all the relevant though diverse synergies on board in the quest to minimise the impact of disasters within the given localities in the various economic facets.

2.10 Supply chain collaboration

The efforts by public and private sector partners in managing disaster risks are fragmented (UNISDR and PricewaterhouseCoopers 2013: 10). Comprehensive disaster risk reduction covers a wide range of disciplines, sectors and institutions, calling for diverse and expanded forms of partnerships. Partnerships can be more successful in reducing risks than individual or specialist contributions. According to UNISDR (2004: 223), impact of these partnerships varies from one country to another depending on the institutional arrangements and capacities as well as the political and administrative commitments of the various governments to disaster risk reduction. The Supply Chain Council Risk Research Team (2008: 28) emphasises the need for cooperation among departments in the same organisation and among different organisations in the supply chain to save resources and improve effectiveness. Cooperation fosters sharing of information and removes duplication and ineffective activities. There is no consensus between government and the private sector on who has the responsibility to minimise the risks associated with disasters. The private sector assumes that the service sector and government sectors are responsible for disaster response and, therefore, take no precaution (Silva and Reddy 2011: 112), while the public sector views the private sector as an innovation leader on disaster risk management (UNISDR and PWC 2013: 3; Carter 2008: 23) also notes that organisations must work together in disaster management to prevent, mitigate, prepare for, respond to, and recover from the effects of disaster.

The World Bank (2011: 1) in the Ugandan dairy industry study which assessed the risks facing Ugandan dairy supply chain concurs that there is ambiguity regarding the role of public and private sector and there is need for the clear delineation of the roles and responsibilities of the two entities and the need for the development of mechanisms for the collaboration of the two. The dairy industry seems bright due to the expression of sufficient interest among the stakeholders in order to make the dairy value chain more profitable (The World Bank 2011: 23). In essence, for this development to come to fruition, there is need for concerted efforts to be adopted to mitigate the identified risks in the Ugandan dairy supply chain.

Moreover, Murigi (2013: 976) in the Brooks Dairy Limited study in Kenya recommended that dairy companies should increase their ties with suppliers and partners in the supply chain when crafting their strategic plan to update the coordination and response to alterations in supply environment. In this view the demystification of the strategic decision making process goes a long way in ensuring all-encompassing robust policies and practices that will go a long way in mitigating disaster effects in dairy farming.

Chen,Sohal and Prajogo (2013: 2) concur that supply chain collaboration should be the risk mitigation strategy. They proposed a model in which there are three types of collaboration, namely supplier collaboration, customer collaboration and internal collaboration, as a mechanism to mitigate risks. In addition, both supply risk and demand risk increase process risk. In spite of the prevalent problem of escalating disaster risks, the focus should shift to disaster risk reduction (Chen *et al.* 2013: 3). It is not possible to attain the goal of sustainable development unless there is a shift from relying on reconstruction and relief after a disaster has struck to disaster reduction.

There is, therefore, an opportunity for the public and private sector to collaborate on risk reduction and building resilience. This research, therefore, seeks to explore how collaborative risk management between companies in a supply chain and the public sector could work. Of all the factors influencing the success of supply chain risk mitigation strategies, collaboration (that includes supply chain partners and government)

has received the least attention by researchers. There is also no empirical research that has been published that tests the collaboration framework. This raises a fundamental question: are private-public partnerships effective in disaster risk reduction? What legislation and policies does the government have to put in place to incentivise the private sector to share its knowledge of disaster risk management? If collaboration between the public sector and supply chain partners is fully implemented, will disaster risks and losses really be reduced? This question is highly important when disaster reduction practitioners decide how to invest in such partnership. Against this background, this researcher explores disaster risk reduction strategies in the dairy industry in developed and developing countries in the world.

2.11 Disaster risk reduction in dairy industry

There is no industry that is immune to disaster risks and hence the dairy industry is no exception. With the role the dairy industry plays in agro-based economy of a country there are incentives in investment in risk reduction efforts. Identifying and rating the likelihood of supply chain risks is regarded as an essential prerequisite for managing these risks and eventual survival of firms. However, findings from researches in the dairy industry on prevalent risks have been mixed. Some studies have been done on supply chain risk reduction in the dairy industry in the last decade.

2.11.1 Germany, Netherlands, Ireland, Switzerland and France

Schaper, Lassen and Theuvsen (2009: 7-8), did a study of five European countries (Germany, Netherlands, Ireland, Switzerland and France) to establish the risk perception and risk management strategies of dairy farmers in these countries. The survey focused on comparatively large agriculture enterprises. While Schaper *et al.* (2009: 7-8) in their study of risk management in milk production concur with The World Bank (2011: 10) on market and production risks , they further concluded that farmers also have to live with political and policy risks as well. The study found that market risks have the first priority for the farmers surveyed. Dairy farmers perceive increasing feed prices as the single most important risk. Political risks are ranked second. This category of political risks includes a tighter legal framework for dairy production and increasing

documentation and control requirements (including cross-compliance regulations). The study also highlighted that production risks represent another important group of agricultural risks. Altogether, loss of workers (family or employees) due, for instance, to accident or illness is considered the most important production risk with comparatively severe consequences for the farms. The study revealed that farmers strongly rely on risk acceptance, risk reduction and risk transfer strategies to mitigate against risks.

2.11.2 India

Mishra and Shekhar (2012: 78) studied risks and strategies to deal with factors considered high risk in dairy- food supply chain in India and concluded that the high risks were procurement-related risks, distribution-related risks and processing and transportation-related risks. The risks were supposed to be addressed on priority basis with high risks getting higher priority. Mishra and Shekar (2012: 88) recommended education and training to the retailers, collaboration with production plant, variations in quality from time to time and continuous quality improvement throughout the supply chain as strategies to mitigate against risks. The collaboration raised here is operational level collaboration. If this study was to be replicated in other countries, especially in developing countries and with strategic collaboration, the same results would be established.

2.11.3 Turkey

Akcaoz,Kizilay and Ozcatalbas (2009: 949), conducted a study of dairy farmers in the Antalya province of Turkey in order to establish the risk management strategies in the farms. In the small dairy farms, the most important risk source was milk price variability, the family members' health situation and lack of production hygiene while in medium and large farms, the most important risk source was milk price variability (Akcaoz *et al.* 2009: 951). They have also identified that keeping the debt low, producing at the lowest cost possible and good liquidity conditions are the key risk management strategies followed there.

2.11.4 Australia

Issar, Cowan and Wegener (2003: 6-9), in their study of success strategies in fresh milk supply chains in Australia came up with many strategies that have driven the transformation of the dairy industry. They recommended proactive buyer-supplier relationships, rationalisation of the supply base, innovation environmental sustainability, economic efficiency, strategic orientation, producer activism and better communication. Contrary to Issar *et al.* (2003: 6-9), Mishra and Shekhar (2012: 88) in their research on supply chain risks in Indian dairy industry came up with different conclusions and recommendations. Their approach includes training and educating staff, continuous quality improvement throughout the supply chain, motivating producers to join societies and coordination among stakeholders. In a research on risk management tools for dairy farmers, Shields (2011: 13-16) emphasised the need for forward contracts, hedging futures and options, maintaining cash reserves, government assistance, and diversification of farm operations and pursuing off-farm income as the suitable strategies to manage risks.

Of note in all of these studies is the absence of the emphasis in collaboration and the role of the public sector in the implementation of their strategies. This is surprising, given the evidence that companies typically struggle to initiate and implement some strategies to reduce vulnerability for the reduction of disaster risks. It is also clear that all the studies have been emphasising more on the operational level than on the strategic level. However, academic studies on the impact of collaboration on prevalence of disaster risks in dairy supply chain in the country remain very scant. This study, therefore, seeks to fill the gap by examining the impact of supply chain collaboration model on the prevalence and recurrence of disaster risks (disaster risk reduction) in the dairy supply chain in Zimbabwe.

2.12 Conclusion

This chapter reviewed various sources of literature from an international perspective, to help explain the need for disaster reduction and collaboration by stakeholders in disaster situations. Theoretical views from various sources were reviewed and analysed and necessary recommendations were made. Literature reviewed suggests that the implementation of collaborative strategies will reduce disaster risks.The chapter also identified knowledge gaps by evaluating related empirical literature. The biggest gap in supply chain risk management research is in its empirical research. Most of the empirical work in supply chain risk management has been done in the pharmaceuticals, electronics and motor industries and in developed countries yet the developing countries are more prone to supply chain disruptions. For example risks such as natural disaster risks have been more prevalent in developing countries such as Zimbabwe but no single research has been done in Zimbabwe. While there are empirical studies conducted focusing on the dairy industry, there are no studies in this industry that have purely tested a disaster risk management framework. With an increase in global demand (an increase of 3% globally, but more than 10% in some developing countries, and 15% in China) for milk and milk products (More 2009: 6) there is an increased need for researchers in disaster risk management and reduction to have interest and research in the dairy supply chain as well. The reviewed literature suggests that governments should proactively involve private sector in formulation of policies and action plans. The private sector participation in policy making play an important role in DRR as they have project management capabilities, skills, knowledge, assets and experts.

The next chapter covers a Zimbabwean perspective of the disaster risk reduction in dairy supply chains.

Chapter 3

Disaster risk reduction in dairy supply chains: A Zimbabwe perspective

3.1 Introduction

This chapter outlines the history and background of disaster risks plaguing the Zimbabwe dairy supply chain. It also covers the legal framework for disaster reduction in Zimbabwe and also other Acts that underpin disaster risk reduction activities and management in Zimbabwe. The chapter concludes by looking at the disaster risk reduction strategies in place to manage the manmade and natural hazards.

3.2 Disasters Plaguing Zimbabwe

Zimbabwe has a yearly average of 6.8 % of its population affected by natural disasters (Kellett and Spark 2012: 23). The topmost hazard plaguing Zimbabwe is drought, followed by HIV, crop pests and animal diseases, traffic accidents, veld fires, other human diseases and finally floods (Bongo, Chipangura,Sithole and Moyo 2013: 1). The following empirical studies carried out in the various areas in Zimbabwe will be chronicled to show Zimbabwe's vulnerability to disasters.

3.2.1 Droughts

Benson and Clay (1994: 10) define drought as an exogenous supply-side shock which usually causes sharp decline in agricultural output, employment, export earnings and income levels. Wilhite and Glantz (1985: 4) identify four types of drought which comprise; meteorological, hydrological, agricultural and socio-economic. The mention of agricultural drought is of pertinence to this study because it seeks to establish the major causes of supply chain disruptions in the dairy industry. What distinguishes these droughts from one another is their impact on affected communities (Wilhite and Glantz 1985: 4-8). These types of drought have costly indirect consequences such as price increases, increased food imports, migration from rural to urban areas, and step-like

changes in environmental degradation (Dairibord Holdings Limited 2015). Given the milk deficit the country is experiencing, these hydrological droughts have forced Zimbabwe to rely highly on milk imports.

Benson and Clay (1998: 8) also assert that the impact of droughts tend to spread throughout the economy by way of sectoral linkages and multiplier effects which result in disaster. The multiplier effects in various sectors of the economy is also of importance to this study where the drought impact is assessed to establish how the chain reaction goes on to affect dairy supply chains. The dairy industry particularly the processors, are affected as the supply of milk dwindles following the devastating effects of the hydrological disaster. Droughts have devastating impact on the nation's food security since agriculture is at the heart of the Zimbabwe economy (Gasana, Bell, Kajume, Mupindu and Smith-Jon 2011: 9). This study therefore seeks to examine the droughts that Zimbabwe experienced and explore the impact these droughts had on the agricultural sector and on the dairy supply chain in particular.

3.2.2 The 1992 Drought in Zimbabwe

The drought of 1992 was declared a national disaster by the head of state and the government of Zimbabwe had to intervene by establishing an inter-ministerial drought taskforce led by the Vice President to respond to the disaster. The 1991/1992 drought was one the worst droughts to hit Zimbabwe (Maphosa 1994: 53). This drought led to the intake by the Grain Marketing Board of only 13, 000 tonnes of maize that year, enough to last Zimbabweans for two days (Gumbo 2006: 3; Maphosa 1994: 53). In addition, more than a million cattle were killed as a result of starvation induced by the drought (Maphosa 1994: 53; Gumbo 2006: 3). The drought also affected the country's supply of hydro-electric energy due to water shortages and reduced flows (Gumbo 2006: 3). Lake Kariba's water level and capacity, which supplied approximately 80 % of the country's hydro-electric energy, dropped to 40 % and any further drop would have made generating electricity impossible (Gumbo 2006: 3).

The impact of the drought was felt by individual farmers as well as all the industries dependent on agricultural raw materials such as milk and beef processing (Maphosa 1994: 53). The imports inflated costs such that demand reduced across the country including agricultural inputs and basic consumer goods.

3.2.3 The 1995 Zimbabwe Drought

The 1995 drought exposed Zimbabweans' vulnerability to famine and hence the head of state had to declare yet another state of disaster(Chigodora 1997: 5). This declaration obligated the government to take necessary action to protect the public from the devastating effects of drought by providing relief. According to Chigodora (1997: 5), the relief took three forms; the Grain Loan Scheme (GLS) which was estimated to benefit about 5.05 million Zimbabweans; the Free Food Programme (FFP), which was estimated to benefit about 733,000 as well as the Supplementary Feeding Programme (SFP), which was estimated to have benefited more than 800,000 children. The Grain Loan Scheme laboured under the assumption that the coming season would be a normal one (Chigodora 1997: 5). Despite these noble efforts put in place by the government to alleviate the effects of droughts, food security continues to be an issue of concern as the economies of most developing countries are agro-based and operate in drought prone environments where these disasters are ever recurring.

3.2.4 The 2008 Drought in Zimbabwe

As a result of the El Nino induced drought in 2008, the estimated national maize production in Zimbabwe dropped from the domestic maize demand of 1.1 million tonnes to an output of only 475,000 tonnes in 2008 due to drought (The World Bank 2014: 14). Prices of utilities such as water and electricity went up as a result of the drought which impacted on their availability and cost since the dairy processors had to resort to alternative sources of energy (Dairibord Holdings Limited 2015: 14).

3.2.5 The 2015/2016 Drought in Zimbabwe

The head of state declared the year 2016 a state of drought disaster in response to the EL Nino induced drought threatening food security in (Southern African Development Community (SADC) and United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) 2015: [1]). Combined with critical water shortages, tens of thousands of cattle succumbed to drought-related deaths (SADC Agromet Report 2016: 1). Grazing conditions remained poor in most of the southern half of the region (SADC Agromet Report 2016: 81). According to the Southern African Development Community (SADC) and United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) (2015: [1]) the highest deaths of cattle due to 2015/16 drought were recorded in Chiredzi (2,638), followed by Chipinge (2,600), then Mwenezi (1,993), Tsholotsho (1,145) and Binga (993). The most vulnerable population is in the rural areas where there is limited access to food and a total of 2.8 million people faced food and nutrition insecurity in 2016 (Zimbabwe Vulnerability Assessment Committee (ZimVAC) 2016: 10).

3.3 Flood Disasters in Zimbabwe

Rural communities that are in valleys such as Muzarabani and Mbire in Zimbabwe are vulnerable to floods (Gwimbi 2009: 16). Muzarabani experiences perennial flooding during the rainy season from January to March (International Federation of Red Cross and Red Crescent Societies (IFRCRCS) 2007: [1]). The flooding usually damages infrastructure, sweeping away houses, washing away crops and livestock (IFRCRCS 2007: [1]). The government together with the IFRCCS through its local agent, the Zimbabwe Red Cross Society collaborated to provide assistance to the affected communities in the form of food, shelter and sanitary materials (International Federation of Red Cross and Red Crescent Societies (IFRCRCS) 2007: [1]). The Zimbabwe Meteorological Services forecasted a looming flood disaster in Muzarabani for the 2014/2015 rainy season caused by excessive run-off from the mighty Zambezi River (OCHA ROSA 2014: [6]). The Department of Civil Protection put in place contingency plans to curtail the disaster in the case of an emergency, however, the challenge that

the country faced in taking proactive measures through awareness campaigns are the limited resources (OCHA ROSA 2014: [6]). Other areas prone to the risk of flooding are Tsholotsho, Chikwakwala and Sabi valley (OCHA ROSA 2014: [6]).

In the year 2014, the government of Zimbabwe declared a national disaster following extensive flooding in the catchment area of the Tokwe-Mukosi dam under construction where 60 000 people were affected when their homes, livestock and crops were destroyed (International Federation of Red Cross and Red Crescent Societies (IFRCRCS) 2014: [1]). An additional 4 000 who resided downstream on the Tokwe-Mukosi basin were at high risk of being swept away by the floods as well as being exposed to diseases such as malaria and cholera caused by unclean water sources in the relocation camps (Bote 2014). Despite the government facing resource constraints, through the Civil Protection Department, it managed to evacuate the affected communities and launched a $20 million dollar appeal to the donor community, to mitigate the impact of the disaster (IFRCRCS 2014: [1]).

3.4 Cyclones

There has been an increase in the incidences of cyclones in Zimbabwe and this has been attributed to climate change. In the year 2000, Zimbabwe was hit by tropical cyclone, Eline. Cyclone Eline caused flooding in the Zambezi basin, killing 700 people, rendering over 500,000 homeless and destroying infrastructure worth US$1 billion (Gwimbi 2009: 16). The devastating cyclone Eline resulted in damage to infrastructure such as telecommunication networks, roads, bridges and power networks were washed away(Food and Agriculture Organisation (FAO) 2000: [1]). Massive landslides that blocked roads were witnessed in Manicaland province (United Nations Country Team 2000: 2). This cyclone occurred at a time when the country was experiencing a serious economic crisis characterised by shortage of petroleum fuels, lack of foreign currency for procurement (United Nations Country Team 2000: 2). The government of Zimbabwe had to intervene by making an appeal for assistance through the UNDP (United Nations Country Team 2000).

Tropical cyclone Japhet of 2003 also caused flooding in Guruve and Muzarabani districts in the Zambezi basin (Madamombe 2004: 1-2). The Cyclone was characterized by strong 110 km per hour winds, with gusts reaching up to 140 km per hour. The rains damaged crops, destroying 237,000 hectares of crop fields and killed 2,495 livestock in Southeast Zimbabwe and parts of Mozambique.

3. 5 Road Disasters in Zimbabwe

Road accidents claimed 735 lives and injured over 433 people between 1982 and the year 2003 in Zimbabwe with the head of state declaring 19 bus accidents national disasters (Chikoto and Sadiq 2012: 5). The number of road accidents in Zimbabwe increased from 16,904 in 2008 to 29,423 in 2012 and are likely to continue rising (Government of Zimbabwe and United Nations 2012: 10). Notable among these accidents is the 1989 Chivake bus accident that claimed the lives of 79 people and injured 21 people. The bus plunged onto the dry riverbed of Chivake River as a result of poor visibility caused by fog. In 2003, a train collided with another goods train carrying flammable liquids at Dete, killing 50 people.

3.6 Veld fires

National Environmental Management Authority (NEMA) (2009: 1) defines veld fires as " blazes that get out of control, become wild, and destroy extensive tracts of forests, grasslands, animals, people and their properties in the process". Nyanga, Chimanimani, Mutare, Hwange, Umguza, Hurungwe, Makonde, Kadoma, Chegutu, Mazowe, Bindura and Kwekwe are more vulnerable to the risk of fire. In Zimbabwe, veld fires are a single significant threat to national economic recovery plans as these fires destroy pastures necessary for the livestock restocking exercise and vast plantations (NEMA 2009: 3). They are also a threat to food security in Zimbabwe, as these veld fires have burnt wheat and maize fields in the past few years (NEMA 2009: 3). NEMA sends daily fire alerts to every provincial and district office in Zimbabwe for circulation to various stakeholders that include; Meteorology Services Department, Agritex, ZINWA, Forestry

Commission, universities, SIRDC, Local Government and the Civil Protection Unit. These alerts enhance preparedness of stakeholders to put off the fires.

3.7 Animal diseases

In 2015, Foot and Mouth Disease (FMD) which affects livestock was widespread in Matabeleland South (Gwanda), Midlands (Gokwe) and Masvingo provinces and parts of Manicaland (Chipinge South) and Mashonaland West (Ngezi) (SADC and UNOCHA 2015: [1]). The national herd declined after the onset of the land reform programme as natural hazards like cow diseases also contributed to the calamity.

3.8 Armyworm and Locusts

Zimbabwe is prone to army worm and locust invasion during times of heavy rainfall. All provinces in Zimbabwe were affected by armyworm during the 2002/2003 rain season, which affected 50-200 hectares of land (Food and Agriculture Organisation (FAO) 2003: 6). The 2012/2013 rainy season saw six out of the eight Zimbabwe rural provinces, namely Mashonaland Central, Mashonaland West, Mashonaland East, Manicaland, Midlands and Matabeleland North being hit by an armyworm outbreak (Coordination of Humanitarian Affairs (OCHA) 2013: 1). The armyworm spread fast destroying hundreds of hectares of crops and green pastures (Commercial Farmers Union (CFU) 2013: 1).

3.9 Human diseases

The impact of epidemics such as HIV/AIDS, points to a future where disasters could increasingly threaten the world's economy, and its population and the sustainable development of developing countries (UNISDR 2009: 4). HIV prevalence in small towns, farming estates and mines located in rural areas exceeds that in the major cities, whilst transmission into and within subsistence farming areas is also high (Betera 2011: 51). The epidemic has caused loss of many lives which threatens the existence of the human race and as such it is a global disaster. A record 83,000 HIV/AIDS related deaths were recorded in 2009 alone and the number of children orphaned due to HIV/AIDS in Zimbabwe is approximately 1 million (Duri, Stray-Pedersen and Muller

2013: 20). Sexual relations within marriage are for procreation while those out of wedlock are for economic survival owing to the economic hardships in the country and this has caused the continued infection of sexually transmitted disease which facilitate the transmission of the AIDS virus (Duri *et al.* 2013: 15). During the period between 1980 and 2005, a total of 504,000 children were vertically infected with HIV during birth (Duri *et al*. 2013:18).

Zimbabwe has not been able to fund its response to HIV/AIDS through domestic and international sources of finance and consequently, the Government of Zimbabwe used the Presidential Powers (Temporary) Regulations to declare HIV/AIDS a national disaster (Duri *et al*. 2013: 19). These special presidential powers legally empowered Zimbabwe to manufacture antiretroviral generic drugs locally. Given the disastrous nature of the AIDS pandemic, the Government of Zimbabwe established a national AIDS Trust Fund commonly known as the AIDS levy which raised funds through tax deductions of 3 % from taxable individual and corporate income support AIDS programmes like the Anti-Retroviral Therapy, Voluntary Counselling and Testing in order to mitigate its impact (Duri *et al*. 2013: 19). According to Betera (2011: 52), the Government of Zimbabwe tasked the National AIDS Council with coordinating AIDS programmes in Zimbabwe in a multi-sectoral approach to fighting HIV and AIDS to ensure that all sectors play a role in the fight against the pandemic. Such noble collaborative measures have seen over 50 % reductions in adult HIV incidence for the past decade and 47 % reduction in HIV and AIDS related mortality (Government of Zimbabwe 2014: 7).

Cholera is also an epidemic which affects Zimbabwe particularly in drought prone areas. Betera (2011: 48) asserts that the most vulnerable communities are those that live in areas with poor water and sanitation, temporary settlements and overcrowded slums. The worst cholera outbreak in Africa in 15 years occurred between August 2008 and July 2009 and infected 98,592 people and resulted in 4,288 deaths (Smith 2009: 5). The government has since put in place a strategic plan for cholera control (Betera 2011: 48) to mitigate the impact of this deadly disease. Some rare diseases in Zimbabwe also

pose potential threats to the health and livelihoods of population. Although the impact of disasters described in this study was not specific to the dairy supply chain it is assumed that they have the same negative impact on this industry. Though Zimbabwe has experienced many disasters since independence in 1980 with widespread impact, previous researches in Zimbabwe have generalised on the presence of these disasters in the Zimbabwean economy, not streamlining the existence of these disasters in the dairy industry. This research seeks to answer the following question. How widespread are disaster risks in the dairy industry in Zimbabwe?

3.10 Supply chain risks plaguing the Zimbabwe Diary Industry

3.10.1 Financial risks

The dairy industry is naturally capital intensive (Hahlani and Garwi 2014: 90). Viable dairy farming requires huge capital investment to purchase the required dairy infrastructure. Milk output requires good cold storage facilities, sanitary milking conditions and proper transportation. The dairy farmers are facing challenges in putting up such infrastructure. The high perishability of milk requires dairy farmers to make substantial capital investments right from production up to sale. The procedure to be followed when obtaining finance for agricultural extension services is rather onerous. The procedures are highly bureaucratic in nature (Hahlani and Garwi 2014: 92). Restrictions stemming from borrowing procedures amplify the probability of exposing dairy farmers to supply chain risks and disruptions. Dairy farmers receive small and irregular loan amounts and as a result could not expand dairy herd because of lack of capital (Hahlani and Garwi 2014: 90). Vulnerabilities in the banking sector are being characterised by rising credit risks with smaller banks. Solvency concerns continue to persist (Commercial Farmers Union 2014: 2).

The insecure land tenure system in Zimbabwe resulted in the reduction of investor confidence (World Bank 1991, cited in Hahlani and Garwi 2014: 93). Credit providers have become more risk averse and are equally reluctant to offer loans to farmers producing on land that lacks collateral value. Loan advances are less frequent and

irregular for the farming sector. Most dairy farmers do not have access to long-term loans due to the lack of collateral security. Women entrepreneurs are hit most as banks demand collateral security in the form of properties in urban areas for then to access business loans. Fewer women than men own immovable assets (Zimbabwe National Chamber of Commerce (ZNCC) 2016: 20). These manmade risks contribute to supply chain disruptions particularly the input side given that dairy farming is capital intensive. The farmers also lack funds to finance the purchase dipping chemicals since animals diseases are a major drawback to dairy productivity. The lending rate is 14% (Commercial Farmers Union (CFU) 2014: 2) which makes the cost of capital expensive. The financial services products are not customised to suit the nationalised land tenure system which leaves farmers with no collateral. Available financing is more suitable for short-run farming projects; there is limited availability of medium to long term finance for the broader agricultural sector. This is, however, posing serious challenges to the operational efficiency of the industry. The government has not put in place an enabling environment concerning individual property rights. The state owned bank, AGRIBANK, which was commissioned to fund farming businesses is currently financially constrained. Many companies including those in the agro industry are having difficulties in funding their operations in terms of replacing old equipment in order to enhance efficiency and competitiveness against imported products (CFU 2014: 2).

3.10.2 Input risks

The most important dairy component is the livestock itself-the heifers. Building the dairy herd takes long gestation periods of up to nine (9) months. The long gestation makes it difficult to grow the herd much faster to boost milk output. Zimbabwe's electricity is provided by a state owned monopoly, the Zimbabwe Electricity Supply Authority (ZESA). According to Anseeuw *et al.* (2012: 122), local Zimbabwe energy supply is estimated at 40 % of demand at peak periods. The country is dependent on energy imports of up to 35 %. The prevailing foreign currency shortages and lack of firm power contracts have forced the power utility to resort to load shedding. This has seen the decrease in capacity utilisation in the agricultural sector. The rampant power cuts are

negatively affecting the Zimbabwean economy at large. It is against this background that the study seeks to assess the impact that these risks have on dairy supply chains.

African Development Bank (ADB) (2011: 36) estimates that Zimbabwe's total investment cost in electricity rehabilitation of existing generation facilities and new generation would amount to US $4.33 billion. This is a major challenge as the country's credit worthiness is low due to large debts accrued with international funding institutions and targeted sanctions (Reserve Bank of Zimbabwe (RBZ) 2006: 4-7). The low power generation is a major hazard as it is contributing to supply chain disruptions on the input side. The technology on most productive commercial dairy farming set ups requires electric power to run the machinery. The dry spell usually experienced in the Southern African region is further threatening power supplies since they are mostly hydro-generated.

Forty five percent of power generation in sub-Saharan Africa is represented by hydro-power (Battes *et al*. 2008). This has resulted in disruption in power supplies in the agricultural sector. The dairy sector is very vulnerable as it requires electrical power to run the milk chillers to maintain the high quality of milk standards and reduce perishability. The largest lake in Zimbabwe, Lake Kariba, has succumbed to the drought as evidenced by the alarming low water holding capacity it now has. This is not a good sign given the scale of the energy capacity of the Kariba power station. If these dry spells continue, the problem is likely to intensify and plunge the country into darkness and this will be disastrous as most of the power in the country is hydro-generated. Furthermore, the Zimbabwe dairy supply is also exposed to high labour costs. A study on the viability of small dairying in Wedza, Zimbabwe sensitivity analysis indicated that increases in total variable and labour costs reduced returns and income could not cover costs (Zvinorova, Halimani, Mano and Ngongoni 2013: 1007-15). In like manner, dairy farmers faced high costs to breed or purchase cross breed heifers which become a dairy production constraint (Hahlani and Garwi 2014: 90).

3.10.3 Political risks

The underperformance of the agricultural sector can be largely attributed to poor government policies and subsequent droughts. During the period from 1998 to 2000, Zimbabwe experienced negative economic growth. There was political instability in Zimbabwe that was brought about by the ill-managed land reform programme. Zimbabwe Human Rights NGOs Forum (2010: 5) postulates that the government's continued disregard of court rulings on land rights has contributed to failure of the agricultural sector. The underperformance of the agricultural sector has led to transformation of market dynamics. Zimbabwe now relies on food imported from neighbouring countries. The dairy sector has not been spared from the dilemma.

The dairy sector was also negatively affected by the land reform programme as dairy commercial farmers lost their farms (Mzumara 2012: 41). It is estimated that the dairy herd was reduced by 50 % from what it was before the land reform programme in 2000. Land tenure and security of tenure is not conducive for dairy farmers to invest and expand their operations, resulting in milk quantity as well as quality significantly declining (Marecha 2013: 14). Most able bodied people have migrated from the dairy farms to cities to look for jobs or join the informal sector.

The decision by the Government of Zimbabwe to implement the land reform programme was a noble idea. However, this programme has received an aura of negative criticism across the globe when it was not properly implemented. The land grabs that took place in 2000 to 2008 have not only dented the nation's reputation but have also been to the detriment of the agricultural sector. Agriculture was once the back-bone of the Zimbabwean economy; all that is history as productivity has gone down dramatically. The failure by the Government of Zimbabwe to observe the rule of law has Weak agricultural policy reforms are a direct interference with individual political interests. The Zimbabwe government continues to ignore the ruling that was passed by the SADC tribunal court which required Zimbabwe to pay white farmers displaced by the land reform (Dumon 2013: 1). This reflects its unwillingness to provide a favourable

environment for agricultural activities to be carried out. The political influence has even ruined farming support organisations.

Colonial agricultural policy, since 1912, favoured white commercial farmers (Hahlani and Garwi 2014: 87). Things changed after independence, government policies in place favour the black indigenous commercial farmers. Prior to the implementation of the land reform, large scale commercial farming dominated in the production of marketed livestock products (Anseeuw *et al*. 2012: 46). After the launch of the land reform cattle population dwindled, reflecting the retrogressive nature of the programme. The depletion of the national herd had negative effects on the productivity of the dairy sector. According to Anseeuw *et al.* (2012: 118), political commitment to create an enabling environment for investment growth in Zimbabwe is questionable and uninspiring.

Some ills are evident in the manner in which the land reform programme was administered. Some politically influential individual farmers, who are army officers and senior government officials, are using their own influence to drive policy decisions to their own advantage in order to maximise the benefits they reap from government programmes (Mudimu 2003: 5). Political interference is the major hindrance for policy implementation which supports all farmers. Productivity of the farms continues to go down after the introduction of the land re-distribution. The political risks brought about by the land reform administration have induced exposure to risks that result in financial loss across all agricultural supply chains.

The period from 2011 to date has been characterised by massive de-industrialisation and de-agriculturalisation. The macro-economic environment’s hostility continues to intensify and hinder agricultural growth. Zhou (2012: 45) noted that Zimbabwe's civil service salary budget in 2011 accounted for 63 % of total budget in an effort to curb the severe brain drain it experienced in the last decade. This left the government with no funding to support infrastructure development, policy development, social services among other government mandates. The other challenge that local farmers face is their

limited capacity to influence policy outcomes. Intervention by NGOs is heavily restricted by the restrictive political environment. Governance concerns continue to block any progressive success made towards foreign interventions in the form of assistance from emergency interventions to long term development support.

Regional politics also contributes to exposure of Zimbabwe to natural hazards. Zimbabwe, Zambia, Tanzania, Mozambique, Botswana, Malawi and Angola are countries that contribute to the Zambezi river basin that formed the Zambezi Watercourse Commission (ZAMCOM) protocol (Manyeruke, Hamauswa and Mhandara 2013: 282-3). The idea behind the ZAMCOM protocol was the need to integrate management of shared water from the mighty Zambezi River. The Government of Zimbabwe wanted to draw water to boost irrigation water supplies in its country's more arid areas that recorded low levels of rainfall. This would help alleviate the effects of drought for the rain fed agriculture, for both livestock and crops. Zambia to date has refused to ratify the protocol because it claims that the river covers a large area on its part of the country and hence the water source should provide more benefits to any other country. This move by Zambia has downcast the efforts by the Zimbabwe government to mitigate the effects of climate change (Manyeruke *et al.* 2013: 283).

3.10.4 Competition risks

Zimbabwe's dairy industry has been dominated by large scale producers and processors since before trade liberalization in year 1991. While liberalization of the agricultural markets introduced competition in the supply of agricultural commodities and products, former marketing boards such the Dairy Marketing Board (DMB), continued to be lead the market distorting effective competition (Makamure *et a*l. 2001: 8). It is not easy for small new entrants to enter the market. With its capital intensive nature, new players cannot get in and out of milk production easily (Makamure *et al*. 2001: 30). Consequently the dairy industry continues to be dominated by a few players.

3.10.5 Natural disaster risks

The ubiquitous nature of natural hazards makes it difficult to control them without due collaboration with other stakeholders across supply chains. Agricultural shocks like cyclones, droughts, animal diseases, unforeseen bad weather conditions plague the dairy farming industry. Unexpected climate change affecting Zimbabwe and other southern African countries are exposing dairy farmers to both production and marketing risks. They tend to affect many farms and dairy processing firms. Secondary data that is available on climatology such as rainfall pattern erraticism and extreme weather events in Zimbabwe shows that the country is already experiencing the effects of climate change (Brown, Chanakira, Chatiza, Dhliwayo, Dodman, Masiiwa, Muchadeyika, Mugabe and Zvigadza 2012: ii).

Crops and livestock are finding it difficult to adapt to the harsh climate that is prevailing in the region. The release of greenhouse gases by highly industrialised nations like China, Japan, USA and India have accelerated the depletion of the ozone layer which is causing drastic climate changes (Manyeruke *et al*. 2013: 271). The unbearable high temperatures resulting from the heat wave are shrinking Zimbabwe's main farming regions and resulting in the expansion of the dry regions that are less productive. These human induced climate changes are caused by the greenhouse effect (Manyeruke *et al.* 2013: 271) and mostly affect African countries like Zimbabwe resulting in food insecurity. The challenges posed by the unforeseen climate changes are depleting the most important natural resource, water. It is increasingly becoming difficult to sustain viable agriculture given such harsh unpredictable weather conditions for many agro-based economies like Zimbabwe. Rain fed agriculture is becoming less reliable to maximise agricultural productivity.

Zimbabwe, being an agro based economy faces serious threats from these climatic changes. Dairy farming in particular thrives well in regions which record high rainfall. These erratic rainfall patterns and dry spells are impacting negatively on the productivity

of dairy farms. Natural hazards are likely to intensify and exert damage and destruction to existing infrastructure. The low rainfall recorded across the country is making dairy cattle breeding more difficult by the day as cows require abundant pastures (Masama 2013: 49).

The implementation of strategies and projects to cope with variable climatic change are proving to be ineffective. Extreme weather conditions are also expected to increase in frequency especially floods, droughts and tropical storms (Brown *et al.* 2012: 1). Chagutah (2010: 56) notes that Zimbabwe in particular is at high risk and very vulnerable to these climate changes because of its heavy reliance on rain fed agriculture.

3.10.6 Technology risks

Poor technology, among other factors has adversely affected capacity utilization in the milk processing industry (Nyamwanza *et al*. 2015:7). Marecha (2009: 14) notes that dairy farmers face technological risks as they have problems cooling milk in areas without electricity and adversely affecting the quality of milk. Consequently other farmers use hand milking which is quite difficult for large herds. In the next section, the disaster risk reduction framework in Zimbabwe will be presented and discussed in detail.

3.11 The disaster risk reduction legal framework in Zimbabwe

Disaster legislations are one of the instruments that can highlight the efforts and commitment a country has in disaster reduction and management practices. This researcher finds it imperative to briefly highlight the legal and institutional framework that deals with disaster risk reduction and management in Zimbabwe from national down to the district level. To mitigate and prepare for hazards facing Zimbabwe, the Government of Zimbabwe created the Department of Civil Protection and charged it with the onus of coordinating and managing disasters and reducing hazards (Chikoto and Sadiq 2012: 1).

3.11.1 Civil Defence Act of 1982

During the colonial era, Zimbabwe's colonial government (the then Rhodesia) referred to disaster management as civil defence. At Independence (1980), this *status quo* was adopted and eventually civil defence was administered through the *Civil Defence Act* of 1982. The Government of Zimbabwe established a national board, the Civil Protection Unit (CPU), currently housed within the Ministry of Local Government, Rural and Urban Development, to foresee and coordinate disaster management in the country. The Department of Civil Protection's main focus is on hazards such as drought, floods, epidemics, transportation accidents, fires and environmental degradation. In Zimbabwe, the powers to declare a state of disaster are vested in the President of the Republic in the Government Gazette. During disaster circumstances in Zimbabwe, it is the prime responsibility of the state to provide assistance and protect the persons affected by the disaster in any area within Zimbabwe. However, non-state actors can, from time to time, assist the state in assisting the communities affected by a disaster but the state retains the overall coordination role in addressing the disaster. Section 27(1) of Part VIII of the Civil Protection Act Chapter 10:06 of Zimbabwe provides for the declaration of the state of a disaster by the President, that:

> *"If at any time it appears to the President that any disaster is of such a nature and extent that extraordinary measures are necessary to assist and protect the persons affected or likely to be affected by the disaster in any area within Zimbabwe, or that circumstances are likely to arise making such measures necessary, the President may in such manner as he considers fit declare that, with effect from a date specified by him in the declaration, a state of disaster exists within an area defined by him in the declaration".*

The act was repealed by the Zimbabwe Civil Protection Act of 1989.

3.11.2 Civil Protection Act 1989

The concept of disaster management has evolved and developed from civil defence to civil protection, and has now transformed into disaster risk management (DRM). This led to the enactment of the *Civil Protection Act* 5 of 1989. According to the guidelines of this legislation a Civil Protection Fund, designated for the development and promotion of civil protection activities (Betera 2011: 6), was setup using the available government resources and once these resources become exhausted, the head of state then declares a state of disaster to appeal for international assistance (Bongo *et al*. 2013: 2). Department of Civil Protection in Zimbabwe manages a Disaster Fund, which is financed by the Central Government. The National Civil Protection Plan forms the overall framework for the promotion, co-ordination and execution of emergency and disaster management in Zimbabwe. The localised plans should dovetail with the National plan.

According to Betera (2011: 6), the Civil Protection Act of 1989 empowers the relevant authorities to direct the activities of both public and private entities towards the provision of emergency services. This creates a conducive environment for collaboration to take place in averting and mitigating against disasters and this study seeks to investigate collaboration strategies that are being implemented to reduce supply chain risks due to disasters as well as determine the impact of private and public sector partnership efforts in disaster risk reduction on dairy supply chain performance in Zimbabwe. As a result of the perennial nature of droughts that continues to strike the country. The 1989 legislation was repealed by the Civil Protection Act of 2001 (Chapter 10:06).

3.11.3 Zimbabwe Civil Protection Act of 2001

The Civil Protection Act of 2001 resulted in the setting up of a Civil Protection Department under the flagship of the Ministry of Local Government, Rural and Urban Development (Bongo *et al*. 2013: 3). The Civil Protection department was tasked with the mandate of preparing for, providing for prevention where possible as well as mitigating the effects of disaster whenever it occurs. This was a reflection of

government's commitment to disaster management (Betera 2011: 5). The 2001 Civil Protection Act was to be followed by the draft Disaster Risk Management (DRM) Bill of 2003 that is waiting promulgation by Parliament.

3.11.4 Emergency Preparedness and Disaster management Bill

The Civil Protection Act has weaknesses which need attention. A draft bill which was in conformity with the International standards and the Hyogo Framework of Action (Betera 2011: 11) was crafted. "*It was a derivative of the Yokohama Strategy and sought to; ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation; Identify, assess and monitor disaster risks and enhance early warning; use knowledge, innovation and education to build a culture of safety and resilience at all levels; reduce underlying risk factors as well as strengthen disaster preparedness for effective response at all levels"* (Betera 2011: 12).

The Civil Protection Act is undergoing revision to pave way for the Emergency Preparedness and Disaster Management Act to address structural and organisational gaps to ensure a multi-sectorial representation (World Meteorological Organization (WMO) 2005: 62). The Emergency Preparedness and Disaster Management was thus drafted in 2003 and is yet to be considered in parliament (UNISDR 2005: 5). The new act would allow the formation of an Emergency Preparedness and Disaster management Authority, which would be mandated with key activities which include forecasting and planning for emergencies at different levels. That is from the grassroots namely, local authority, district, provincial and national level. Thus the above stated authorities would be required to produce operational disaster emergency preparedness and response plans, and they would be activated when a disaster hits. Again these plans including those from the grassroots have to merge with national plans.

Besides the Zimbabwe Civil Protection Unit efforts, there has been increased focus on disaster risk reduction by other sectors of government. The Zimbabwean Civil

Protection Act works closely with, among other acts, Environmental Management Act, Chapter 20:27 , the Rural District Councils Act (29:12), Urban Councils Act (29:14), the Water Act No. 31 of 1998, Defence Act (11:02) , Police Act (11:10) and the Public Health Act (15:09) (Shamano 2010: 67).

3.11.5 Zimbabwe Environmental Management Act 13 of 2002

This act governs issues to do with sustaining management of resources and environment protection in Zimbabwe (Chagutah 2010: 19). The Act aims at strengthening of environmental impact assessment requirements and subsequent monitoring. Prior to its enactment, environmental policy was highly fragmented and appeared in a number of policies and action plans. The Environmental Management Board appoints officers and inspectors to enforce this Act and any regulations made under it. In enforcing this Act these officers and inspectors enter any land, premises, vessel, vehicle or any other place in Zimbabwe to determine whether the provisions of this Act are being complied with. The officers or inspectors also examine any activity which they reasonably consider to be detrimental to the environment or natural resources and require the production of, inspect, examine or make copies of any permit, licence, records or other documents issued or required to be kept or exhibited in terms of this Act or any other enactment. This policy is of importance to the study as natural resources management has to do with studying soil structure, grazing land to determine suitability of land for agricultural purposes. Water as the most valuable natural resources required government to enact legislation for its conservation and effective management since Zimbabwe is very prone to drought induced hazards.

3.11.6 The Zimbabwe National Water Act No. 31 of 1998 and the Zimbabwe National Water Authority (ZINWA) Act No. 11 of 1998

The devastating effects of the 1991/92 drought led to the promulgation of the National Water Act and the ZINWA Act (Chagutah 2010: 19). The National Water Act provides legislation which foresees the administrative structure for water management. This framework has a provision for drought preparedness which takes a proactive stance

when it comes to water management. It allows for adjustment of water allocation and usage to different users basing on assessment of the vitality of the natural resource (Chagutah 2010: 20). Despite these efforts, demand for water continues to exceed supply and is expected to worsen owing to climate change (Chagutah 2010: 20); this has detrimental effects on agriculture in Zimbabwe since the country is an agro-based economy and this may be tantamount to disaster should these climatic changes become adverse. Disaster preparedness to mitigate these meteorological hazards in the event of a disaster depends on the information disseminated by the meteorological services department.

3.11.7 The Zimbabwe Meteorological Services Act of 1990

This Act establishes services whose purpose includes carrying out meteorological research and investigation and issuing weather forecasts; these climate forecasts alert vulnerable communities on life endangering and property damaging weather conditions (Chagutah 2010: 21). The weather data gathered during meteorological researches is particularly important for climate adaptation and planning for concerned ministerial sectors so that they improve on mitigation of hazards. The Zimbabwe legal framework has evolved since the establishment of the Civil Defense Act of 1982. The Civil Defense Act was repealed by the Civil Protection Act of 1989 and 2001. In 2004, Zimbabwe had a draft Emergency Preparedness and Disaster Management Bill which is yet to be passed into law. It is the intention of this research to establish the adequacy of the Zimbabwe legal framework as a strategy to reduce disaster risks and as an environment for the implementation of collaborative strategies.

3.11.8 Zimbabwe statutory instrument 64, 2016

The government has introduced Statutory Instrument number 64 of 2016 (Control of Goods (Open General Import Licence No 2.) amendment notice, 2016 No 8). Under this instrument, the minister of Industry and Commerce is now required to authorize the importation of dairy products among other products by the issuance of a valid import

licence to individual travellers and traders. The affected dairy products include all liquid and powdered milk as well as other dairy related products such as yogurts and cheese.

3.12 Disaster risk reduction strategies in Zimbabwe

The World Bank (2006: 25) advises that “Improving management of agricultural risk has significant potential to increase productivity-enhancing investments in agriculture”. Measures involved in disaster risk reduction usually need to be implemented from senior levels of government. A single organisation or community is unlikely to be able to institute disaster reduction efforts (Carter 2008: 217). The possible approaches as suggested by Carter (2008: 217-218) are national disaster policy, legislation, assessment and monitoring, planning and organisation, public awareness and education, warning systems, institution building, incentives, specialist programmes, national development plans, international assistance and development of self-reliance and self-help at community level. Carter (2008: 225) suggests an approach that involves governments, communities; and others concerned to assist in identifying needs and establishing practical solutions as this will result in a combined sense of responsibility in program implementation. However, inadequate or lack of coordination and collaboration by government departments, community and private organisations in disaster management may result in sub-standard levels of preparedness, prevention and mitigation for disaster risks (Carter 2008: 238).

3.12.1 Early Warning Systems

Early warning Systems (EWS) are important tools for disaster risk reduction. The purpose of early warning is to aid data collection that facilitates detection and monitoring of looming disasters so that actions can be taken to reduce the negative effects of disasters such as personal injury, deaths and damage to property, or surrounding environments. In Zimbabwe, traditional EWS by traditional leaders such as chiefs, *nyusa* (rainmakers), soothsayers, *n’angas* (traditional healers and seers), prophets and older citizens are heavily relied on (Shamano 2010: 83). They are believed and followed by a considerable population in Zimbabwe. Example of traditional EWS that the

community rely on are abundance of fruits such as mangoes and *makwakwa* as symbolic of a poor rainfall season ahead while good fruiting of amarula indicates a good season is in the offing. Early warning information is accessed through formal and informal channels of communication such as radio, TV, informal community networks and interaction with officials.

Shamano (2010: 83) study on disaster preparedness at community level found out that communities used indigenous early warning systems which assisted them to predict a looming disaster. It was noted that there was lack of collaboration among members of the community where the knowledge on these indigenous early warning systems was not widely shared. The impact of famine, floods and disease have adverse impact as they often result in loss of life, starvation, disruption of social life, loss of livelihoods and loss of shelter.

3.12.2 Legislation

The Government of Zimbabwe showed commitment in averting disaster on the inception of the Civil Protection Act of 1989. The renewal of its legislation in 1992 was geared at strengthening disaster risk reduction.

3.12.3 Zimbabwe National Contingency Plan

The Government of Zimbabwe through the Ministry of Local Government, Rural and Urban Planning's Department of Civil Protection (DCP), other Government ministries, UN Agencies and various Non-Governmental Organisations (NGOs), developed a National Contingency Plan that is updated annually to reflect the evolving hazard profile of the country. The national contingency plan of 2012 identified hydro-meteorological hazards (floods and droughts), biological hazards (Gastro Intestinal Infections) and technological hazards (Road Traffic Accidents - RTAs) as the key hazards affecting Zimbabwe.

3.12.4 International assistance

Zimbabwe is among the top 40 recipients of Disaster Risk Reduction (DRR) financing from humanitarian organisations looking at individual countries. However, there is still concentration of DRR financing by these humanitarian organisations within the top four recipients (Pakistan, India, Indonesia and Bangladesh) (Kellett and Sparks 2012: 3). The farming community has formed collaborations with NGOs to try and mitigate exposure to risk. There are many NGOs providing assistance in the agrarian sector in Zimbabwe of which Technoserve, Land O'Lakes, European Union, USAID and Zimbabwe Agricultural Competitive programme (ZimACP) are active in providing support and assistance to the dairy farming sector (Anseeuw *et al.* 2012: 10). The activities of these organisations are coordinated by the Food and Agriculture Organisation.

3.12.5 Policy

In a plight to increase agricultural activity and curb the risks posed by natural hazards in Zimbabwe various stakeholders have formed collaborations.

3.12.5.1 Comprehensive Agricultural Policy Framework (2012-2032)

Due to changes that have taken place in the socio-economic environment, such as the land reform programme, there has been a need to review the national agricultural policy. The policy aimed at, among other issues, increasing production and productivity of livestock and improved animal health and welfare in the country (Government of Zimbabwe 2012: 11-12). The policy also seeks to mitigate the negative impact of HIV and AIDS on agriculture. The Comprehensive Agricultural Policy Framework also recommended agricultural subsidies so that local farmers will be able to compete with foreign imports.

Despite these noble efforts, a gap still exists in terms of agricultural policy formulation and implementation which will guide any programmes directed towards mitigation of

natural hazards and meteorological disasters like drought. Zimbabwe has to date made four attempts to create a comprehensive policy (Anseeuw *et al.* 2012: 76). These policy attempts include the Zimbabwe Agricultural Policy Framework and Strategy (1995-2020); National Agricultural Strategy Framework, (2005-2035); Agricultural Mission Statement Strategy Framework and Action Plan, (2007-2011) and Zimbabwe Regional Agricultural Policy draft (Nyanga Document).

3.12.6 Education, training and awareness

Education and training strengthens all aspects of disaster risk management at all levels. Disaster Risk Management (DRM) education can be introduced in school curricula. Zimbabwe has made success in integrating DRR and emergency preparedness into its education system. Education would be a handy strategy with most dairy farmers (96%) literate as they have attained the minimal formal education (primary level), and are able to interact with dairy extension officers (Stichting Nederlandse Vrijwilligers (SNV) 2013: 16). Similarly conferences compliment formal education and workshop training. In the Conference of Parties for climate change (COP21) deliberations were made on solutions to reverse the grave and capricious impact of climate change on the world water systems (Nhlapho 2015: 40). The summit was held at a time when most Southern African countries were beset by silting river beds, drying livestock among other disasters consequently, livestock and crops have succumbed to these arid conditions which are not conducive for agricultural projects to run smoothly.

3.12.7 Insurance

Insurance reduces individual loss exposure thus spreading risks by collecting premiums from many individuals and paying for damage caused by natural disasters that is very large for individual households and companies. Agricultural insurance policies cover against a variety of risk including drought, floods, hail storms, wind damage, fire loss, fog heat waves and the all-important rainfall deficit. Zimnat livestock insurance insures farmers against fire, theft, lightning, explosion and death of livestock killed while

anywhere in the premises or, any adjacent premises by arrangement for grazing (Zimnat Lion Insurance 2016: [1]).

Tsikirayi, Makoni and Matiza (2013: 8) in a study they carried out, found that out of a total of 25 registered insurance companies in Zimbabwe, 15 insurers, representing about 60%, currently provide agricultural insurance. However, the results also show a low penetration of agricultural insurance products in Zimbabwe. Furthermore, the research showed that insurers do not provide specialized agricultural insurance packages.

3.12.8 Cooperatives

There are 20 functional Milk Collection Centres (MCC) around Zimbabwe with a membership of 1,743 smallholder dairy farmers. They operate as cooperatives and process milk for their members. The MCC collects milk on trucks from small scale farmers scattered around the MCC instead of individual farmers delivering on foot, bicycles or scotch carts (Kagoro and Chatiza 2012: 24).

3.12.9 Technology

Nyamwanza *et al*. (2015:6), in a study of three dairy firms in Zimbabwe, found that all dairy farmers made investment in technology in a bid to reduce production costs. However, Company A is still operating at between 20% to 40% levels of capacity due to lack of resources to support this initiative. Investment in technology could not bring the expected results in the dairy industry due to factors such as power shortages, weak government policies and interest rates. This shows that these disaster risk reduction strategies are interlinked and do not work in isolation. The core guiding questions should be: How much have these strategies been applicable in the dairy industry in Zimbabwe? To what extent has the adoption and implementation of the above disaster reduction strategies in Zimbabwe affected the prevalence and impact of disaster risks in the Zimbabwe dairy supply chain? What collaborative strategies have Zimbabwe used

in disaster reduction in the dairy industry? How have the disaster management strategies fared in reducing disaster risks in Zimbabwe's dairy supply chain?

3.13 Collaboration in disaster reduction in Zimbabwe's dairy supply chain

Zimbabwe has set up the Civil Protection Unit (CPU) that focuses on response preparedness, coordination of different humanitarian organisations and assistance in disaster recovery. The CPU is coordinated by the Ministry of Local Government, Public Works and Urban Development (Government of Zimbabwe 1989). The CPU relies on the other government departments, the private sector and NGOs, which normally contain elements of prevention and community development. The importance of collaboration is also echoed by Mbohwa (2010: 192) when he recommended that the World Food Programme (WFP) in Zimbabwe engage in collaborations with the corporate world and the military to improve efficiency and effectiveness in disaster awareness. The WFP can collaborate with private sector and other NGOs sharing information, systems, resources and knowledge in radio, satellite, licensing and hardware to improve their responsiveness to humanitarian needs (Mbohwa 2010:192).
Collaboration is also evident in Zimbabwe's dairy sector. Land O'Lakes in partnership with National Association of Dairy Farmers (NADF) set up an Accounting Bureau System to improve the levels of financial management at the Milk Collection Centres (MCC) in Manicaland province of Zimbabwe (Land O'Lakes 2014: [1]). The NADF is providing each MCC with profit and loss statements. Land O'Lakes trained member representatives from the milk producer associations, their executive committees and centre administrators in good record keeping system. Through the same partnership community livestock workers received training in basic animal health and artificial insemination techniques and 783 households were trained in dairy management. All farmers at MMCs in Manicaland received cattle on a loan from a cattle bank scheme.

Likewise, milk processing companies such as Dairibord Zimbabwe Holdings, Nestle Zimbabwe and Dendairy are putting in place measures to mitigate the dairy dilemma

through heifer programmes. Dairibord Zimbabwe pioneered the importation of 1000 heifers to boost milk production and managed to procure a total of 330 heifers under the heifer procurement programme (Dairibord Holdings Limited 2015: 18). The livestock was distributed to small, medium and large scale farmers across the country in an effort to ensure continuity of supply across Dairibord Zimbabwe's supply chains. According to Dairibord Holdings Limited (2015: 18), this milk supply intervention has realised benefits as it has contributed 8% to the milk supplies for Dairibord Zimbabwe. This research study seeks to explore collaborative arrangements in Zimbabwe's dairy industry and establish their impact on the performance of the dairy chain.

3.14 Challenges thwarting mitigation efforts

Collaborative measures and mitigation strategies in place are down played by a number of factors which are discussed below. The functionality of NGOs is stifled by unfriendly government policy which makes their relationship with government hostile. Many NGOs prefer to work alone as they accuse Government of putting obstacles in their way. The Government of Zimbabwe's unwillingness to be associated with countries with a low Human Development Index (HDI) makes it much harder for them to function effectively (Brown *et al*. 2012: 19). The major challenge, however, that Zimbabwe is facing in such endeavours is the lack of clear linkages between the government itself and civil society. This will consequently become a limiting factor and lead to mal-adaptation of the strategies by civil society (McDevitt 2009: 4). All these conditions created by the government intensify the propensity of exposure of Zimbabwe's agricultural sector to natural hazards. Literature from Darfur supports the above on how scepticism between government and NGOs hinder collaboration. In Darfur region NGOs faced challenges in accessing conflict affected areas because government complicated the procedure to obtain permission to travel to such areas and to offer health services. The government was sceptical of NGOs' intentions and fear they might be harbouring political intentions (Yagub 2014: 570).

Zhou and Zvoushe (2012: 220) state policies and strategies are made to meet the interests and needs of the ruling elite without inputs from the concerned stakeholders to address economic and political problems. Instead, policymakers are originating a policy for the environment. This shows a disintegrated strategy which makes it difficult to put in place pro-active mitigation strategies to cope with natural and man-made hazards. Kagoro, and Chatiza (2012: 28) report on small holder dairy programmes in Zimbabwe revealed that economic situation of the country has left the government underfunded and unable to provide services to dairy farmers such as breeding, extension, research and general human resource development. The situation has affected the availability and cost of feeds, medicine, energy, labour and finance. Liquidity problems have affected operational and capital investments. Most of the dairy schemes that had been setup by the Dairy Development Programme (DDP) became dysfunctional during the 2007/2008 period because of the hyperinflationary environment in the country (SNV 2012: 6). In the same manner, the lack of knowledge and skills has hampered smooth collaboration among stakeholders in dairy industry. To increase the agricultural production levels government needs to provide knowledge and training in large scale commercial farming (Mabaye 2005). In like manner, literature on Darfur shows engagement between government and NGOs in collaborative initiatives failing as government personnel lacked knowledge, skills and capacity (Yagub 2014: 570).

3.15 Conclusion

The chapter discussed the natural and man-made disasters that are threatening the operations of the Zimbabwe dairy sector. It also focused on the mitigation strategies put in place by the government to avert disasters. Notable among the strategies this researcher discussed collaboration by dairy supply chain stakeholders. Challenges weighing down on collaborative efforts were also deliberated on. The chapter that follows, Chapter 4, addresses the research design and methodology.

Chapter 4

Research Design and Methodology

4.1 Introduction

This chapter outlines the research methodology used to achieve the objectives of this study. It also discusses the research design, sampling methods, and research instruments as well as data analysis techniques. The research philosophy adopted for the study is also highlighted together with the relevant justification for the chosen research techniques. The methodology is derived from the literature review that has been carried out.

4.2 Objectives

The study was carried out under the following objectives:

- To explore the disaster risks that plague the Zimbabwe dairy supply chains.
- To explore the impact of disaster risk on dairy supply chains in Zimbabwe.
- To investigate collaboration strategies being implemented to reduce supply chain risks due to disasters in Zimbabwe.
- To determine the impact of private and public sector partnership efforts in disaster risk reduction on dairy supply chain performance in Zimbabwe.
- To ascertain factors that thwart disaster reduction in dairy supply chains in Zimbabwe.

4.3 Research paradigm

A paradigm is a worldview that researchers hold about reality. There are mainly two paradigms to the verification of theoretical propositions, namely: positivist and interpretivist/phenomenological paradigms (Neville 2007: 5). A third paradigm, pragmatism, that combines the first two paradigms has also been suggested (Saunders, Lewis and Thornhill 2009: 119).These paradigms are discussed below.

4.3.1. Positivism

Positivism is a systematic way of doing research which emphasises the importance of observable facts. According to Babbie (1995: 48) the modern challenge to positivism goes beyond the question of whether humans behave rationally, and asserts that positivistic social scientists have sometimes erred in assuming that human beings always act rationally. Positivistic approaches seek to identify, measure quantitatively and evaluate any phenomena and to provide rational explanation for it (Neville 2007: 6). Positivism has a strong tendency to establish causal links and relationships between the different elements (or variables) of the subject and relate them to a particular theory or practice. Walliman (2011: 21) posits that positivism aims at developing a unique and sophisticated description of any chosen aspect that is true regardless of what people think; it builds facts on what is already known. The positivism paradigm is appropriate for studying a large number of respondents hence research findings can be generalized to different situations. However, the major weakness is that it is limited in understanding social processes such that supply chain and disaster issues that are qualitative may not be captured. Such descriptive issues that need verbal description are obtainable from the participants through interviews and observations rendering the positivism paradigm inadequate for this research.

4.3.2 Interpretivism

Interpretive approaches are particularly concerned with understanding behaviour from the participants' own subjective frames of reference (Neville 2007: 6). According to Walliman (2011: 21), interpretivism maintains that the view of the world we see is a creation of the mind based on our perceptions as well as influenced by our preconceptions. One strategy supported by proponents of this approach is to pay attention to common sense, as it provides useful insight into how human beings understand their own situations and enables the researcher to see how individuals construct and understand their situations intuitively (Mason 1996: 6). Interpretivism is, therefore, inadequate approach as some issues to do with disasters risks are quantitative. Interpretivists come up with personal and detailed hence they may not be

generalised. The weaknesses of interpretivism and positivism paradigms rendered them inappropriate for this research leading the researcher to apply pragmatism.

4.3.3 Pragmatism

Following the inadequacy of the above two paradigms, this study followed the pragmatism paradigm.The pragmatists seek to adopt a position that is realistic in practice, that is, usefulness and relevance. It seeks to adopt a method that is appropriate and gives a relevant view of the world (Saunders *et al*. 2009: 119). Choosing between one position and the other is unrealistic in practice and it is argued that the most determinant position to adopt is guided by research questions (Saunders *et al*. 2009: 109). This research follows a pragmatic philosophical worldview as it grants the researcher the freedom to use both quantitative and qualitative research methods to gain meaningful, realistic insights into disaster risk reduction as it occurs in the real world (Creswell 2014: 11; O'leary 2010: 128-129). Pragmatic philosophical worldview recognises that every method has its limitations and that the different approaches can be complementary. The mixed methods approach enabled this researcher to choose an appropriate method to answer specific research questions than to align with a specific paradigm (Ritchie, Lewis, Nicholls and Ormston 2014: 22). With the pragmatic paradigm; words, pictures, and narratives were used to add meaning to quantitative data while numbers were used to add precision to words, pictures, and narratives (Johnson and Onwuegbuzie 2004). This researcher was able to answer a wide range of research questions because the researcher was not confined to a single approach.

4.4 Research design

The research design serves as a master plan of the methods used to collect and analyse the data (Hair, Bush and Ortinau 2006: 21). This researcher used a descriptive research to portray an accurate profile of the dairy supply chain disruptions in Zimbabwe. Descriptive design allowed this researcher to gain meaningful insights into the collaborative strategies adopted by dairy farmers, dairy industry authorities (Farming bodies, the Ministry of Agriculture and Irrigation Development) as well as non-

governmental organisations. Walliman (2011: 10) postulates that descriptive research designs rely on observations as a means of collecting data. Furthermore, descriptive research allowed this researcher to give a detailed description of the impact of the natural hazards that were causing disasters plaguing the dairy industry and how the farming community was working towards reducing them.

To allow the researcher to enhance reliability and completeness of the data collected, the triangulation technique was used combining a number of data sources (Walliman 2011: 73). Triangulation entails the use of several different research methods to test the same finding (Babbie 2004: 113). The study was carried out using a mixed methods approach which employs both quantitative and qualitative methods. The mixed research method combined the best of both paradigms thus overcoming the weaknesses of each (Creswell 2014: 17; Saldanha and O'Brien 2014). The logic of triangulation is based on the premise that no single method ever adequately solves the problem of rival explanations (Cohen, Manion and Morrison 2007: 142). Creswell (2014: 3) postulates that quantitative and qualitative research methods should be viewed as complimentary and appearing on a continuum where one research may be more biased towards either extremes. Creswell (2014: 4) postulates that mixed methods research is an approach which collects and integrates both qualitative and quantitative methods and also uses distinct designs that may involve philosophical assumptions and theoretical frameworks. The use of mixed research methods enables the researcher to increase the reliability and validity of the research instruments. The triangulation approach allowed combining the best of both qualitative and quantitative methods and overcoming their weaknesses providing a more complete understanding of the research problem (Saldanha and O'Brien 2014; Creswell 2014: 17). The weaknesses of one research instrument are balanced by the strengths of other methods used in the same study. The combination of qualitative and quantitative approaches provides the most complete or insightful understanding (Creswell 2014: 4).

Creswell and Clark (2007: 30) posit that the quantitative approach makes use of closed questions that relate variables to each other. The qualitative approach is the systematic

analysis of socially meaningful action through the direct, detailed observation of people in natural settings in order to arrive at understanding and interpretation of how people create and maintain their social worlds (Denzin and Lincoln 2005: 3; Neuman 2006: 88; Payne and Payne 2004: 175). This should allow the researcher to derive meaningful data of the dairy farming activities as they occur in their natural setting. For qualitative data, the researcher made use of observation notes and interview transcripts (Walliman 2011: 71). The qualitative research approach used involved holding semi-structured interviews with the dairy officer and milk products retailers. These interviews were recorded on site as the researcher made visits to the dairy farms and viewed the grazing pastures in the farmlands in Zimbabwe. Leedy and Ormrod (2005: 94) assert that qualitative research is used to answer questions about the complex nature of phenomena, often with the purpose of describing and understanding the phenomena from the participants' point of view. Qualitative data allowed this researcher to gain deeper insights into the dairy industry and gather information from respondents who are hands-on in the dairy industry supply chain. The quantitative research approach used involved administering a structured questionnaire on dairy farmers.

4.5 Research methodology

This study was carried out in two phases. The research methodology for each phase is discussed separately. In phase 1 data was collected using a quantitative approach in which dairy farmers were asked to complete a questionnaire. In phase 2 a qualitative approach was used as dairy officers and retailers were interviewed using two different interview guides.

4.5.1 Dairy farmers questionnaire

Structured questionnaires were used and responses were chosen from five options and in other cases from two options. Questionnaires were self-administered allowing this researcher to clarify any doubts and ambiguity the respondents might have with some of the questions. This researcher persuaded the respondents to participate in the research in order to have a high response rate (Walliman 2011: 71). A pilot study was conducted to test for face validity of the questionnaires (Saunders *et al*. 2009: 146).

Content of the structured questionnaire

The questionnaire consisted of six (6) sections which are as follows:

Section A: Biographic data

This section covered questions regarding the gender, age, experience level of education and location. The purpose of that information was to establish if there is a relationship between biographic data and prevalence of disasters, impact of disasters, disaster risk reduction strategies and the effectiveness of disasters reduction strategies.

Section B: Supply chain disaster risk in dairy industry

Questions in this section dealt with risks that affect dairy supply chain.

Section C: Impact of disaster risks on dairy supply chains

The impact of disaster risks on Zimbabwe's dairy supply chains was captured in this section.

Section D: Collaborative strategies

This section of the questionnaire gathered information on collaborative strategies used in dairy supply chains in Zimbabwe.

Section E: Effectiveness of collaborative strategies

Questions in this section inquired about the effectiveness of collaborative strategies which dairy supply chain partners use.

Section F: Challenges affecting collaboration

This section gathered data on the challenges affecting the implementation of collaborative strategies with dairy supply chain partners.

4.5.2 The sampling process

4.5.2.1 Target population

Kolb (2008: 192) defines a population as a group of elements which share characteristics defined by a researcher. For the structured questionnaire this researcher's target population was made up of dairy farmers in Zimbabwe. Therefore, the population of this study consisted of 189 dairy farmers and milk processors found throughout Zimbabwe. The potential respondents were dairy farm and milk processing firm managers/owners.

4.5.2.2 Sampling frame

The sample frame with a total of 122 dairy farmers and milk processors was investigated. These farmers and milk processors were located in the major milk producing cities/towns around Zimbabwe which are Chipinge, Mutare, Harare, Gweru and Bulawayo.

4.5.2.3 Sample size

This researcher used a sample of 92 dairy farmers. Sample size was determined using Krejcie and Morgan (1970: 607) model. The model simplified sample size decision by providing a table that researchers use to determine a sample size when all the factors are taken into account. After deriving the sample size, it was divided using proportional allocation for the six selected milk producing regions.

4.5.2.4 Sampling techniques

This researcher used both probability and non-probability sampling. Non-probability sampling depends on the researcher‘s judgment. It is mainly used when the application of probability sampling procedures is not feasible. This used cluster and simple random sampling to derive the study sample. Smith and Albaum (2012: 134) assert that cluster sampling is applicable where the researcher will ordinarily be interested in the characteristics of some elementary element in the population. Cluster sampling technique was used on the population of farmers. The major dairy producing regions (Chipinge, Mutare, Harare, Gweru and Bulawayo) of Zimbabwe were selected on the

basis of total milk production in the country. The above regions are best positioned to provide the required information (Sekaran and Bougie 2009: 278).The researcher also acknowledges that the different weather and climatic conditions, natural hazards and risks exposed to the dairy farmers in the five milk producing town provided a wide spectrum of responses. These five regions formed clusters and simple random sampling was used to derive samples from the clusters. Proportional allocation of respondents was applied to each cluster depending on its size. Simple random sampling was used to derive samples from the dairy clusters. The process of simple random sampling consisted of listing of all elements of the population and numbering the elements of the population. This sample was selected using a table of random numbers. Simple random sampling has the least bias and results from this research was easily generalised to the population (Sekaran and Bougie 2009: 270).

4.6 Reliability of data

Cronbach Alpha test was conducted to measure the reliability of the structured questionnaire. Cronbach Alpha is a reliability test conducted in order to measure internal consistency of the research instrument. The higher the co-efficient; the more reliable the research instrument (Sekaran and Bougie 2009: 205). Cronbach's Alpha values greater than or equals to 0.70 are considered appropriate for social science data.

4.7 Validity of data

A total of 30 respondents were used in the pilot survey in order to circumvent the problem of ambiguity of the questions. A pilot study is a small-scale research project that collects data from respondents similar to those who will be used in the actual study (Zinkmund and Babin 2007: 50). The 30 respondents were divided equally amongst the five milk producing towns/cities. The pilot survey was used as a guided basis for testing content validity. Content validity ensured that the questions in the questionnaire were in line with the scope and aims of the study. Widd and Diggines (2009: 6) state that validity describes research instrument that measures what it is supposed to measure. A pilot study was conducted to test for face validity of the research instrument (Saunders *et al.*

2009: 146). This researcher carried out a pilot study to make sure that the questionnaire is adjusted if there were any issues raised by the respondents as well as testing the perceived validity and reliability of the questionnaire. The pilot study also allowed this researcher to make corrections on ambiguous questions as well as typographical errors. This researcher also tested the content validity of the research instruments. Content validity determine whether the full content of a construct is represented in the measure or are some dimensions left out. Expert judges will participate in the examination of the content validity of the research instruments to come up with content validity ratio (Sekaran and Bougie 2009: 206). The pilot test and content validity ratio led this researcher to determine whether the instruments in this research were valid and reliable or not.

4.8 Ethical principles and considerations

This researcher was honest throughout the research process to give credibility to the outcomes of this study (Walliman 2011: 43). All sources of ideas, concepts, theories, used in the thesis, were acknowledged. This researcher also sought informed consent from participants so that they choose freely whether or not to participate in the survey (Walliman 2011: 43; Sekaran and Bougie 2009: 260). The European Commission (2010: 40) further posits that valid consent must be voluntary and this, therefore, means that the consent must not result from coercion, manipulation, or undue inducements. The researcher developed an informed consent form and acknowledged that participants' rights have been protected during data collection and participants were required to sign before they engage in the research. Participation was purely voluntary and participants were asked to sign voluntary consent forms. The information given by participants shall be treated as confidential to guard the privacy of the participants (Sekaran and Bougie 2009: 259-261). The European Commission (2010: 39) asserts that valid consent must include the following three elements; adequate information, voluntariness and competence.

According to the European Commission (EC) (2010: 39), there should be adequate information availed to prospective subjects on, how it will be done and the quantity of information needed for a reasonable person to make a decision to participate in the study or not. The researcher debriefed participants prior to the commencement of the interviews and provided information that assisted participants to have a picture of what the study is all about on the preamble of the questionnaire. The participants involved in the study should possess mental competence or the capabilities of understanding and providing the necessary information for the research (EC 2010: 41).

Where possible the researcher may have to protect the identity of participants (Creswell 2014: 74) by using pseudonyms and aliases for the names of farmers and places. This allowed participants to contribute freely to the study as well as disclose all necessary information that is pertinent to the study. During data analysis and interpretation, the researcher, as far as possible, provided an accurate account of the data collected. At all costs, the researcher was not found engaging in any scientific misconduct such as suppressing, discriminating or misrepresenting any information to suit his needs or those of participants.

4.9 Data collection Procedures

This researcher sought permission from the Department of Livestock Production and Development in the Ministry of Agriculture, Mechanisation and Irrigation Development, to collect data from dairy farmers. The researcher distributed a total of ninety interviewer-administered questionnaires to dairy farmers. Appointments were made with dairy farmers through telephone and through the dairy officers who frequently visited the dairy farms to take milk samples. The researcher explained, to the respondents, the importance of answering truthfully and assured them of confidential treatment of information gathered. The interviewer-administration of questionnaires to the farmers was fast and responses were instantly gathered.

4.10 Data analysis and interpretation

Quantitative data analysis of questionnaires was carried out using STATA (version 13). Descriptive and inferential statistics were used in analysing data. Descriptive statistics enabled this researcher to analyse and derive useful information such as percentages, frequencies, means and standard deviations. Inferential statistics are used to infer something about the population from which the sample was drawn based on the information summarized in the descriptive statistics. Inferential statistics enabled the researcher to measure the impact of disaster risks and the effectiveness of prevailing collaborative strategies in Zimbabwe's dairy supply chains. Ordinary Least Squares (OLS) regression analyses of models were done. The Tobit model was used to test the robustness of the models.

4.11 Semi-structured interviews with dairy officers and retailers

In-depth one-on-one interviews were conducted with retailers and dairy officers from the department of Livestock Production and Development in the Ministry of Agriculture, Mechanisation and Irrigation Development, to obtain facts and descriptive information (Smith and Albaum 2010: 59). The researcher asked questions and recorded responses on a voice recorder. There was room for probing and clarification and responses were assured to be from the correct source with the requisite knowledge on dairy supply chains. The verbal interactions assisted in obtaining quality responses and accurate data. A structured interview followed the chronology of the interview guide and avoided deviation from the focal area under study. The challenge with these face-to-face interviews was that respondents felt uneasy about the anonymity of their responses (Sekaran and Bougie 2009: 233). However, the respondents were assured that the interviews were purely for academic purposes and the identity of respondents was protected. Observations of non-verbal cues from the respondents were also made.

The retailers registering presence in major towns (Harare, Bulawayo, Mutare and Gweru) and having a wide branch network countrywide was exposed to the research instruments once since they have standardised, highly centralised operating

procedures. This prevented data saturation as data collected may be repetitive and not add value to the study.

4.12 Sampling process

4.12.1 Sample size

In qualitative studies relatively small and purposive samples are used. Sekaran and Bougie (2009: 296) suggest that with in-depth interviews small samples of individuals, groups, or events are chosen as it is not possible to have these in-depth interviews with many elements of the population. Sample sizes should be between 30 and 500 as a rule of thumb and generally interviews use small sample sizes because of their intensive nature (Sekaran and Bougie 2009: 296). It is against this view that this researcher used a sample size of 30 for retailers. Henry (1990: 107) argues against any form of sampling for a population size less than 50. Where the population is less than 50 the entire population should be interviewed. According to the Department of Livestock Production and Development of Zimbabwe deployment records there are 18 dairy officers deployed throughout the country (Harare 5, Bulawayo 5, Gweru 3, Mutare 3 and Chipinge 2). Therefore, a total of 18 dairy officers were not sampled and all the respondents were included in the sample.

4.12.2 Judgmental purposive sampling

Purposive sampling was used in the selection of 18 dairy officers who were rich in information needed for the study on dairy supply chains (Sekaran and Bougie 2009: 285). Under purposive sampling technique the researcher purposely choose who has the relevant information to address the research topic. The purposive sample was done through identification of the respondents that have direct contact with dairy farmers. Purposive sampling allowed the researcher to reach a targeted sample quickly and subjects were selected based on their knowledge. Purposive sampling was also used to sample out the 30 retailers by confining this researcher to specific retailers who could provide the desired information. The retailers chosen were expected to have expert knowledge by virtue of having been in the business for a long-time, and are well

positioned to provide reliable data. The purposive sample of the retailers assisted this researcher to collect data about the dairy industry operations that was pertinent to the study and helped avoid collecting irrelevant data that did not add value to the study.

4.12.3 Ethical principles and considerations

This researcher sought for permission, from the Department of Livestock Production and Development in the Ministry of Agriculture, Mechanisation and Irrigation Development, to carry out the study as well as allow access to information from gatekeepers in the dairy industry. This researcher also sought informed consent from participants so that they could choose freely whether or not to participate in this research (Walliman 2011: 43; (Sekaran and Bougie 2009: 259-261). The information given by participants was treated as confidential to guard the privacy of the participants (Sekaran and Bougie 2009: 261).

4.12.4 Data analysis

Qualitative data collected from in-depth interviews with retailers and dairy officers was analysed according to various themes and patterns emerging from the objectives of this study. These themes were as follows; disaster risks prevalent in Zimbabwe, impact of disaster risk on performance of the dairy supply chain and collaborative strategies in the dairy supply chain.

4.13 Observations

This researcher used observations in conjunction with questionnaires and interviews to increase the reliability of this study. Observations were used because they give access to situations and elements that are not captured by questionnaires and interviews. Natural observer strategy was employed to allow for observations of the appearance of materials, buildings, plants and animals (Walliman 2011: 101). The observations also provided an understanding of behaviours and interactions of people and animals that this researcher later described (Ritchie *et al.* 2014: 250). Observations enabled this researcher to gather a wide range of data to achieve the objectives of this research. The researcher also made observations during visits to farms, processing plants,

Department of Livestock Production and Development and retail outlets to capture some of the disaster risks encountered in the dairy supply chains as well as capture some of the disaster risk reduction measures being done by the government and other stakeholders in disaster preparedness and disaster mitigation. During observations, this researcher took photographs which were used as evidence of the effects of disasters, preventive and preparedness measures (Walliman 2011: 101). This researcher identified the variables to be observed and was able to collect in-depth information about disaster risks, the impact of disaster risks on dairy farming and disaster risk reduction strategies resulting in strong validity of observational research findings. Normally data obtained from observations is more reliable and free from respondent bias (Sekaran and Bougie 2009: 253). The dairy livestock and farming landscape in the dairy industry was photographed to have a true picture of how climatic changes and natural hazards have impacted on them. The researcher made brief notes while observing the appearance of the grazing lands and livestock in their natural state as they appeared and after completing the observation detailed notes were made in narrative form (Kumar 2011: 135).

4.14 Conclusion

This chapter described, in detail, the research design and methodology used in this study and gave justifications for the choice of this research design and methodology. The data collection instruments were explained and described. The study was carried out using a mixed approach which employed both quantitative (semi-structured questionnaires) and qualitative (observation and interview schedules) methods. The quantitative method used questionnaires administered on dairy farmers and the quantitative methods used involved conducting interviews and observations with agricultural authorities and milk products retailers. The reasons for using both qualitative and quantitative methods were elaborated. Chapter five focuses on data analysis, presentation and discussion of the research findings.

Chapter 5

Data analysis, presentation and discussion

5.1 Introduction

This chapter presents the research findings and highlights both qualitative and quantitative data analysis that was obtained through questionnaires and interviews respectively. The responses gathered from the questionnaire were analysed quantitatively using STATA Version 13. This study targeted 92 potential respondents to the questionnaires across five milking regions in Zimbabwe. A total of 79 responses from questionnaires were received, constituting 85% response rate. This researcher in addition to the use of quantitative techniques also used qualitative techniques to analyse data collected through interviews and observations implying that a mixed approach was used in the study. The data was presented in the form of tables and bar charts.

5.2 Demographic Data

The demographic data of the respondents is discussed in terms of age, gender, educational qualification, location, role assumed and experience in the dairy industry.

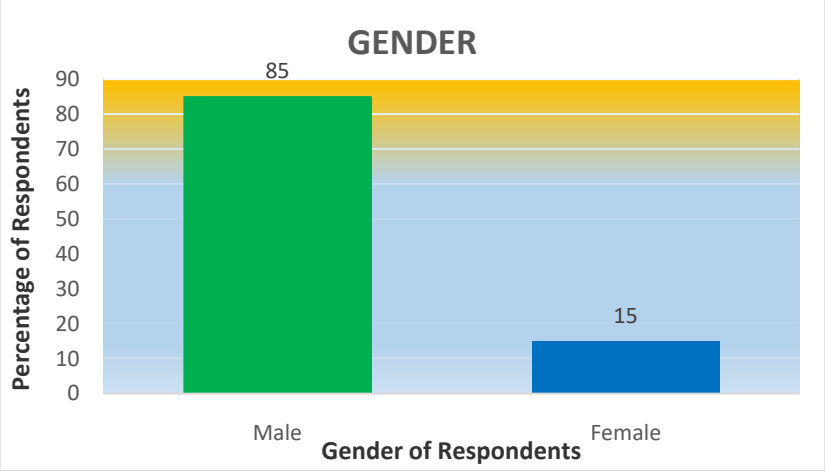

Figure 5:1 Gender of respondents

Based on Figure 5.1, of the 79 respondents 85% were males and 15% were females. This shows an unbalanced gender distribution of dairy farmers dominated by males despite the knowledge that the population of Zimbabwe has more women than men. This agrees with the results of Schaper *et al.* (2009: 6) in a research of dairy farmers' risk perception and risk management strategies in Germany, Netherlands, Ireland, Switzerland and France where 95.7 % of the interviewees were male, 4.3 % were female.

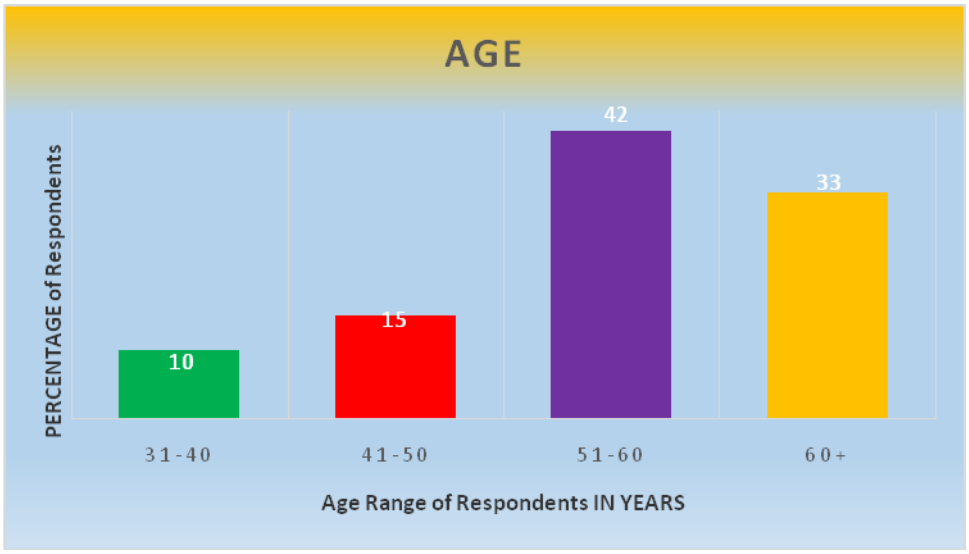

Figure 5:2 Age of respondent

Figure 5.2 shows the age distribution of respondents. From Figure 5.2 it is evident that the majority of respondents (42%) fall in the age range of 51-60 years and a sizable number (33%) were over 60 years. The age groups 31-40 and 41-50 had 10% and 15% of respondents respectively. This is consistent with the fact that the land reform programme benefited senior army and government officials (Mudimu 2003: 5); who are veterans of the liberation struggle and very few youths have benefited from the land reform.

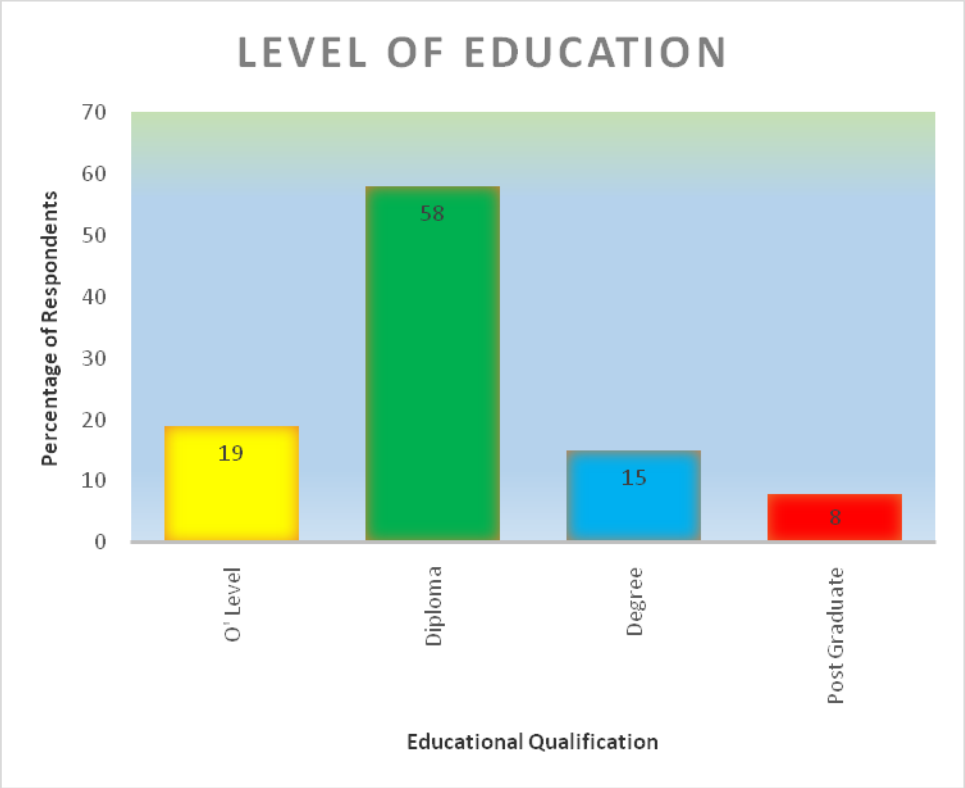

Figure 5:3 Educational attainments of respondents

Figure 5.3 indicates that the respondents had a sound educational background, with the majority being holders of at least a diploma representing 81% (diploma (58 %), degree (15 %), and postgraduate degree (8 %)) of the respondents and 19% had attained O'level certificate. This is consistent with the high literacy level in the country. Most dairy farmers (96 %) are literate as they have attained the minimal formal education (primary level), and are able to interact with dairy extension officers (SNV 2013:16).

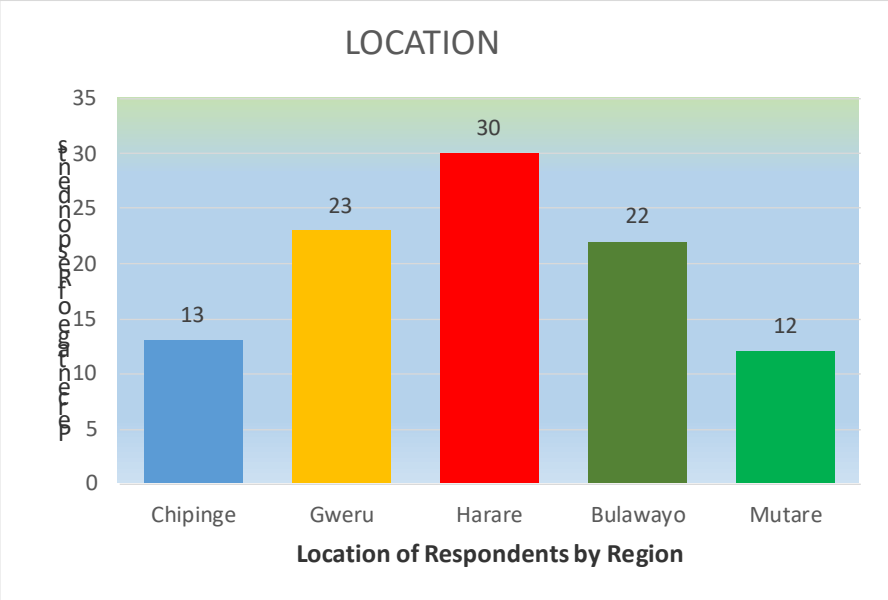

Figure 5:4 Location of respondents

The demographic data also shows the distribution of farmers by region. Harare had most of the dairy farmers contributing 30%, Gweru 23%, Bulawayo 22%, while both Mutare and Chipinge contributed 12% and 13% to the total number of respondents respectively. The researcher used cluster sampling from the milk regions and respondents were proportionally allocated. Most of the sampled dairy farmers were operating in the peri-urban of Harare, which is the capital city of Zimbabwe.

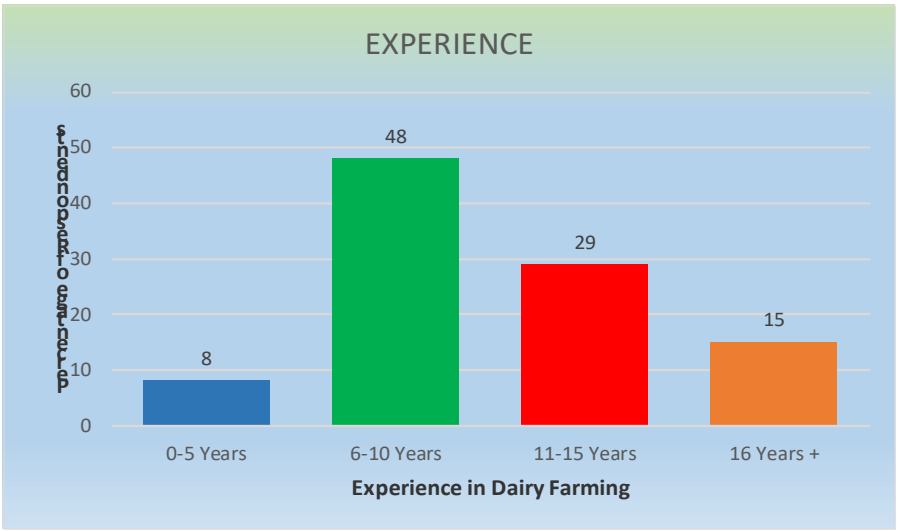

Figure 5:5 Dairy farmer experience

Figure 5.5 show most farmers had dairy experience of between 6 – 10 years (48%), while 8 % had 0-5 years, 29 % had 11-15 years and 15 % had at least 16 years. Experience in dairy farming is important as it shows to what extend disaster risks impact on the respondents' supply chains. It can then be deduced that most of the dairy farmers are relatively inexperienced. The land reform programme of 2000-2008 created a very hostile environment for the white commercial farmers (Zimbabwe Human Rights NGOs Forum 2010: 1) confirmed by only 15% of the respondent farmers having over 16 years of experience.

5.3 Reliability test

Cronbach's alpha coefficient was calculated to measure the internal consistency and reliability of the questionnaire. The values for the reliability coefficient for all the variables in the questionnaire ranged from 0.712 to 0.889 and the overall reliability coefficient was 0.742. The generally accepted lower limit of Cronbach's alpha is 0.7 (Ciudad-Gómez and Valverde-Berrocoso 2014). The values of the Cronbach's alpha coefficient were greater than 0.70 and none of the questions were dropped from the questionnaire. The questionnaire was judged to have relatively high reliability and was used for further analysis.

5.4 Disaster risks affecting dairy supply chain

The major aim of this section is to discuss the research findings from interviews held with dairy officers and retailers as well as questionnaires distributed to dairy farmers.

Table 5:1 Financial risks by gender

Gender	Stats	Loans
Male [M]	Mean	4.273
	Median	4.000
Female [F]	Mean	4.417
	Median	4.000
Total	Mean	4.295
	Median	4.000
Difference [M – F]		-0.144

Source: Primary data

The researcher wanted to know if there existed a bias in financial risk exposure between males and females. The expectations were that female dairy farmers will be more exposed to financial risk than male dairy farmers. The findings in Table 5.1 indicate that both males and females concurred that they were exposed to financial risks. However female farmers were more exposed as evidenced by the mean response value of 4.417 for loan risks as opposed to 4.273 for males. Fewer women than men own immovable assets that banks require for entrepreneurs to access bank loans (Zimbabwe National Chamber Of Commerce (ZNCC) 2016: 20).

Table 5:2 Competition risks by experience

Tenure [Years]	Stats	Local giants	International competition
0 – 5 years	Mean	4.429	4.286
	Median	4.000	4.000
6 – 10 years	Mean	4.541	4.162
	Median	4.000	4.000
11 – 15 years	Mean	4.364	4.273
	Median	4.000	4.000
16 years and above	Mean	4.000	4.250
	Median	4.000	4.000
Total	Mean	4.551	4.218
	Median	4.000	4.000

Source: Primary data

The researcher expected experienced dairy farmers to be less exposed to foreign competition risks than those who had just joined the industry. Results in Table 5.2 show respondents across all ranges of experience (with a median response of 4.00) were exposed to competition from foreign dairy products. Interviews held with retailers and dairy officers show that government has introduced Statutory Instrument (SI) 64 in an attempt to curb foreign competition. Although the government insists that this statutory instrument is aimed to promote and protect local products from foreign goods, this move has apparently fuelled rampant smuggling of these specified goods at the country's borders. According to this researcher's observations, most of the smuggled goods are being openly sold on the informal market. To a larger extend, some of the dairy contraband have also found their way into formal market. This result was expected as local dairy products are more expensive to consumers compared to imports from neighbouring countries (Mugweni and Muponda 2015: 450). These findings are supported by the 2017 national budget where SI 64 was said to have improved capacity utilisation in milling and baking; food, fruits and vegetables processing; iron and steel making; battery manufacturing; packaging; pharmaceuticals; and furniture

manufacturing and dairy was conspicuously absent on the list (Government of Zimbabwe 2016: 22).

Results from table 5.2 indicate that local dairy giants are a threat to dairy supply chain performance as shown by an overall mean of 4.551. This is in support of Makamure *et al*. (2001: 8-30) who postulate that the former Dairy Marketing Board (now Dairiboard Zimbabwe) makes it difficult for small players to enter the market.

Table 5:3 Socio-political risks by region

Region Located	Variable	Mean	Median
Chipinge	Government policies	4.200	4.000
	Political interference	4.200	4.000
Gweru	Government policies	4.111	4.000
	Political interference	3.944	4.000
Harare	Government policies	3.957	4.000
	Political interference	4.083	4.000
Bulawayo	Government policies	4.313	4.000
	Political interference	4.063	4.000
Mutare	Government policies	4.500	4.500
	Political interference	4.200	4.000
Total	Government policies	4.169	4.000
	Political interference	4.077	4.000

Source: Primary Data

The results in Table 5.3 above show mean responses close to 4.00 for political interference revealing a general concurrence among the dairy officers that political interference have resulted in the decline of milk production in Zimbabwe. This is confirmed by findings from interviews held with dairy officers. Some experienced dairy farmers were not growing their dairy herds because of the new land tenure system. The remaining white farmers have been given 5 year leases while many small-scale resettled farmers are holding on to offer letters, the farming permits given to new

settlers by government. The land reform programme has also resulted in the reduced size of landholding thereby, reducing the capacity to expand pastures and other dairy operational activities. Consequently, this has inflated the cost of feeds as farmers now prefer to purchase feeds instead of growing their own pastures at their small farms. A few resettled indigenous farmers have been offered 99 year-long leases. The dairy officers confirm that dairy farming is a long term investment that takes three to four years before a farmer starts reaping rewards. The insecure land tenure as evidenced by the absence of title deeds has left many commercial farmers disadvantaged to an extent that sourcing bank loans is now difficult. These conditions have made investment in dairy farming a big risk. These findings concur with Marecha (2008: 14) who found out that land tenure and security of tenure are not conducive for dairy farmers to invest and expand their operations. The dairy sector was negatively affected by the land reform programme (Mzumara 2012: 41).

Results in Table 5.3 also demonstrate that government policy was a risk affecting all regions under study with mean responses close to 4.00. Interviews with dairy officers confirm that. The agricultural policies introduced by the government were more universal and not specific to suit the requirements of the dairy industry. The livestock policy, land reform policy and the drought mitigation policy, however, were inadequate to address the risks that dairy farmers are exposed to. There is still a gap in terms of agricultural policy formulation and implementation (Anseeuw *et al.* 2012: 76). While the enactment of the Civil Protection Act of 2001 (10:06) confirms government's commitment to disaster risk reduction, it is outdated and plans to replace with DRM legislation are yet to come to fruition as the draft is still to be approved by parliament since 2003 (Government of Zimbabwe and United Nations 2012: 16).

There was a general consensus among respondents that the prevailing legislation, Statutory Instrument 64 of 2016 which calls for importers to apply for licences and justify reasons for their decision to import such commodities was making it more difficult to import resulting in imported milk being expensive. Most of the retailers were in unison that this policy has limited the retailers' capacity to import sufficient milk products to

meet consumer demands. Retailers in the country also argued that foreign products are more appealing to local consumers, a development which has led them to prefer importing milk from outside the country. Descriptive statistics means and medians were obtained for environmental disaster risks. The results are shown in Table: 5.4 below.

Table 5:4 Environmental risks by region

Variable	Chipinge		Gweru		Harare		Bulawayo		Mutare		Total	
Risk	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Drought	1.9	2.0	4.1	4.0	4.3	4.0	4.7	5.0	2.7	2.0	3.8	4.0
Cattle Diseases	4.2	4.0	4.1	4.0	4.2	4.0	4.5	4.5	4.1	4.0	4.2	4.0
Cyclone	4.2	4.0	2.1	2.0	1.8	2.0	1.9	2.0	3.6	4.0	2.4	2.0
Extreme Cold Weather	1.9	2.0	4.1	4.0	4.0	4.0	3.8	4.0	3.2	3.0	3.6	4.0

Source: Primary data

Prior studies have noted that environmental disaster risks in Zimbabwe are determined by ecological region of location. From the results in Table 5.4, it is evident that Harare, Bulawayo and Gweru regions are affected by droughts while Mutare and Chipinge respondents disagree that they are affected. All the dairy officers interviewed across the five milk producing regions reiterated and concurred that meteorological droughts were threatening the operations of dairy farmers. The interviewees concurred that the pastures were depleted by hot climatic conditions that the country experiences during drought years. Some pastures were overgrazed causing depletion which exposes livestock to the harsh effects of drought. This is exposing the livestock to the effects of drought and communicable diseases such as foot and mouth. Bulawayo is the hardest hit region by meteorological droughts because of its location in hot dry Region 5. It can be noted that this result concurs with Bongo *et al.* (2013: 1) who cited drought as the topmost hazard affecting Zimbabwe. Extreme cold weather conditions are negatively affecting the growth of pastures as well as milk yield per cow. Frost causes damage to crops meant for silage during winter especially in Gweru, Bulawayo and Harare. These extreme weather events show that Zimbabwe experiences effects of climate change (Chanakira 2012: ii).

The dairy officers revealed that animal diseases were also prevalent throughout all the regions. Foot and mouth, lump skin, tick-bone and mastitis were cited as diseases affecting milk production with foot and mouth being the biggest threat. SADC and UNOCHA (2015: [1]) found foot and mouth disease widespread in Matabeleland South, Midlands, Masvingo, Manicaland (Chipinge South) and Mashonaland West provinces.

Table 5:5 Technological challenges by age

Variable	**41-40**		**41-50**		**51-60**		**60+**		**Total**	
Technology	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Feeds Processing	4.4	4.0	4.1	4.0	4.1	4.0	4.2	4.0	4.2	4.0
Milking Equipment	4.4	4.0	4.5	4.5	4.2	4.0	4.2	4.0	4.2	4.0

Source: Primary data

Young dairy farmer respondents were expected to have embraced technology faster than their elderly counterparts. However, Table 5.5 indicates that most of the dairy farmers concur that they are failing to grow their operations due to technological challenges such as feeds processing and milking and packaging equipment. Age does not affect vulnerability to technological risks as shown by all age groups indicating a median response of 4.00 on all the technological risks. Observations by this researcher show that technological risks are prevalent in dairy farms as evidenced by the outdated equipment being used to process feeds. In some instances, manual machines are being used to grind maize stalks to feed the dairy cows. Processing speed is very slow thereby exposing the cattle to periods of starvation. The retailers reiterated that local processors were tied down by technological challenges which negatively affected milk output and supply as well. Some retailers revealed that some dairy processors were not consistent in quantity and time of delivery. This is consistent with Nyamwanza *et al.* (2015: 7) assertion that poor technology adversely

affected capacity utilisation in the dairy industry. Marecha (2009: 14) also noted that Zimbabwe dairy farmers face technological risks.

Table 5:6 Production risks by experience

Variable	0-5years		6-10 years		11-15 years		16 years +		Total	
Production risks	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Power Outage	4.6	5.0	4.3	4.0	4.1	4.0	4.2	4.0	4.2	4.0
High Labour Costs	2.1	2.0	2.2	2.0	2.0	2.0	2.0	2.0	2.1	2.0
Cost of Breeding	4.4	4.0	4.1	4.0	4.1	4.0	4.1	4.0	4.1	4.0

Source: Primary data

Table 5.6 indicates that dairy farmers are overally vulnerable to power outages and the high cost of breeding the dairy herd as evidenced by overall median responses of at least 4.00. The results illustrate that there is no significant difference on the exposure of these risks to dairy farmers with varied levels of experience. This result is supported by Hahlani and Garwi (2014: 5) who state that Zimbabwe has high costs to breed or purchase cross breed heifers compared to other neighbouring countries. Erratic supply of electricity also weighed down on dairy farming as farmers have to resort to expensive alternative sources of energy, such as generators, to make up for the shortfall. This is confirmed by the findings by The World Bank (2011: 1) where the assessment revealed erratic power supply among the multiple risks affecting the dairy farming sector. All the regions indicated that they were not affected by labour costs as respondents overally disagreed. This result contradicts findings from Zvinorova *et al*. (2013: 1007-15) in a study of small scale dairy farmers that revealed that increases in labour costs reduce returns and income.

5.5 Impact of disaster risks on dairy supply chain performance

Table 5:7 Impact of disaster risks by tenure

Tenure	Variable	Mean	Median
0-5 years	Impact of disaster risks	4.3	4.0
6-10 years	Impact of disaster risks	4.2	4.0
11-15 years	Impact of disaster risks	4.1	4.0
16 years and Above	Impact of disaster risks	4.0	4.0
Total	Impact of disaster risks	4.1	4.0

Source: Primary data

Table 5.7 reflects the perceptions of dairy farmers on dairy supply chain risks affecting their operations and their corresponding impacts. A mean value of 4.3 for dairy farmers with 0-5 years of experience indicates that new farmers' operations are more negatively affected by dairy supply chain risks. Farmers with above 15 years of experience have a mean value of 4.00 implying that they were less impacted by disaster risks. These results concur with Makamure *et al.* (2001: 8) when he postulates that it is not easy for new entrants to enter the dairy market.

Multiple linear regression analyses (OLS) were used to develop models for predicting the impact of various disaster risks on four dependent variables, job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity. The demographic variables gender, age, level of education, experience in dairy farming and region of location are included as controls. The regression analyses were repeated using Tobit model to test for the robustness of the models. In terms of statistical significance (and the sign of significant effects), there were only two differences between the two models.

Table 5:8 OLS estimates of impact of interest rates risk on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	**Job losses**	**Food security**	**Depletion of herd**	**Hindered growth**	**Productivity**
Loans Availability	0.0139	-0.0223	0.935	-0.134*	0.0872
	(0.105)	(0.0988)	(1.021)	(0.0747)	(0.0710)
Gender	0.0774	0.280	1.704	0.261***	-0.0250
	(0.131)	(0.206)	(1.278)	(0.0789)	(0.169)
Age	-0.0651	-0.0697	-0.459	0.0473	-0.0274
	(0.0613)	(0.0710)	(0.436)	(0.0508)	(0.0536)
Level of education	-0.0698	-0.0877	-0.656	-0.0275	0.0715
	(0.0714)	(103)	(0.504)	(0.0804)	(0.0731)
Experience in dairy	-0.107	0.0154	1.233	-0.0712	-0.166**
	(0.0936)	(0.113)	(1.149)	(0.0756)	(0.0674)
Chipinge	-0.124	0.151	-0.235	-0.0783	-0.349**
	(0.196)	(0.187)	(0.587)	(0.226)	(0.161)
Gweru	-0.149	0.102	0.346	-0.193	-0.234
	(0.162)	(0.138)	(0.630)	(0.186)	(0.169)
Harare	-0.100	0.138	-0.204	-0.0448	-0.172
	(0.168)	(0.163)	(0.487)	(0.193)	(0.181)
Bulawayo	-0.0349	-0.111	3.515	-0.0202	-0.119
	(0.266)	(0.258)	(3.405)	(0.235)	(0.210)
Constant	4.946***	4.472***	-0.754	4.671***	4.439***
	(0.601)	(0.483)	(5.634)	(0.408)	(0.460)
Observations	78	78	78	78	78
R-squared	0.090	0.079	0.096	0.119	0.174

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Statistical significance tests were carried out. Based on the results obtained in Table 5.8 loan availability is not affecting anything except that availability of loans reduce hindrance to growth of local dairy firms as they get capital to finance their operations and acquire new capital equipment to sustain their growth. It was significant at 10% level of significance. The results are consistent with the Tobit model in Appendix I.This confirms the previous research findings that dairy farmers who receive small and irregular loan amounts could not expand their dairy herd due to lack of capital (Hahlani and Garwi 2014: 90).

Table 5:9 OLS estimates of impact of local giants dictating in the market on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food Security	(3) Depletion of herd	(4) Hindered growth	(5) Productivity
Local giants	0.177**	0.126	-0.281	0.0642	-0.0151
	(0.0786)	(0.0783)	(0.464)	(0.0763)	(0.0689)
Gender	0.135	0.328	1.409	0.311***	-0.0487
	(0.139)	(0.222)	(0.974)	(0.0805)	(0.169)
Age	-0.101	-0.0967	-0.355	0.0275	-0.0200
	(0.0608)	(0.0700)	(0.335)	(0.0528)	(0.0529)
Level of Education	-0.105	-0.115	-0.537	-0.0494	0.0804
	(0.0770)	(0.104)	(0.392)	(0.0805)	(0.0753)
Experience in Dairy	-0.0972	0.0252	1.138	-0.0561	-0.174**
	(0.0940)	(0.110)	(1.081)	(0.0814)	(0.0692)
Chipinge	-0.246	0.0758	-0.384	-0.0727	-0.371**
	(0.203)	(0.200)	(0.543)	(0.216)	(0.164)
Gweru	0.0877	0.287	-0.506	-0.0376	-0.298
	(0.230)	(0.172)	(0.715)	(0.244)	(0.200)
Harare	0.231	0.382*	-0.949	0.107	-0.220
	(0.265)	(0.202)	(0.995)	(0.274)	(0.236)
Bulawayo	0.186	0.0455	3.220	0.0519	-0.132
	(0.275)	(0.243)	(3.042)	(0.261)	(0.231)
Constant	4.542***	4.039***	4.194***	3.899***	4.871***
	(0.494)	(0.499)	(1.549)	(0.434)	(0.418)
Observations	78	78	78	78	78
R-squared	0.151	0.103	0.088	0.097	0.161

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interpreting the estimate of the beta coefficient for the local milk giant firm variable (0.177**) in Table 5.9, indicates that the existence of large scale operators in the dairy supply chain leads to job losses as small firms are squeezed out of the market. Large operators act as barriers to entry by new players. This is confirmed by the Tobit model in Appendix II showing the robustness of the model. Previous researches confirm this result. While liberalization of the agricultural markets introduced competition in the supply of agricultural commodities and products, former marketing boards such the Dairy Marketing board, continued to be lead the market distorting effective competition (Makamure *et al.* 2001: 8). It is not easy for small new entrants to enter the market. With its capital intensive nature, new players cannot get in and out of milk production easily (Makamure *et al.* 2001: 30). Large players are more capital intensive as they use labour saving machinery.

Table 5:10 OLS estimates of impact of international competition on job losses, food, security, depletion of dairy herd, hindrance to growth and milk productivity

Variable	(1)	(2)	(3)	(4)	(5)
	Job loss	Food security	Depletion of herd	Hindered growth	Productivity
International competition	0.381**	0.323	1.566	0.0989	0.141
	(0.174)	(0.198)	(1.745)	(0.153)	(0.128)
Gender	0.137	0.338	1.761	0.305***	-0.0205
	(0.138)	(0.215)	(1.341)	(0.0786)	(0.168)
Age	-0.0856	-0.0888	-0.500	0.0352	-0.0309
	(0.0578)	(0.0636)	(0.489)	(0.0507)	(0.0520)
Level of education	-0.0714	-0.0913	-0.605	-0.0370	0.0764
	(0.0789)	(0.102)	(0.477)	(0.0815)	(0.0708)
Experience in dairy	-0.126	0.00238	1.084	-0.0648	-0.179***
	(0.0847)	(0.0988)	(1.024)	(0.0824)	(0.0663)
Chipinge	-0.0226	0.250	-0.131	-0.00239	-0.341**
	(0.209)	(0.201)	(0.602)	(0.218)	(0.163)
Gweru	-0.0272	0.222	0.412	-0.0928	-0.229
	(0.182)	(0.159)	(0.745)	(0.183)	(0.171)
Harare	0.0647	0.286	0.275	0.0292	-0.129
	(0.195)	(0.180)	(0.822)	(0.191)	(0.191)
Bulawayo	-0.00803	-0.0898	3.678	-0.0214	-0.104
	(0.223)	(0.217)	(3.552)	(0.218)	(0.200)
Constant	3.401***	3.007***	-3.163	3.650***	4.237***
	(0.744)	(0.931)	(8.597)	(0.722)	(0.583)
Observations	78	78	78	78	78
R-squared	0.212	0.149	0.103	0.097	0.180

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.10 column 1, shows international competition with a beta of 0.381** indicating that as competition from foreign milk products increases, the local dairy firms will retrench leading to job losses. Appendix III confirms the robustness of the model with the Tobit model showing the same statistically significant results. This is consistent with the literature by Nyamwanza *et al.* (2015: 6) that the influx of milk and milk product imports into the Zimbabwean market at cheap prices has adversely affected production levels in the dairy industry. All the companies surveyed by Nyamwanza *et al.* (2015: 6) felt the impact of the influx of imports consequently affected the level of employment in the country.

Table 5:11 OLS estimates of impact of government policy on job losses, food security, depletion of dairy herd, hindrance to growth and milk

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Government policy	0.102	0.146	-0.765	0.0882	-0.00695
	(0.0915)	(0.110)	(0.916)	(0.0850)	(0.0741)
Gender	0.0969	0.318	1.342	0.309***	-0.0489
	(0.131)	(0.214)	(0.954)	(0.0791)	(0.171)
Age	-0.0740	-0.0852	-0.355	0.0312	-0.0114
	(0.0610)	(0.0681)	(0.349)	(0.0509)	(0.0521)
Level of education	-0.0881	-0.115	-0.411	-0.0496	0.0478
	(0.0870)	(0.111)	(0.346)	(0.0894)	(0.0749)
Experience in dairy	-0.105	0.0223	1.124	-0.0574	-0.169**
	(0.0927)	(0.112)	(1.068)	(0.0789)	(0.0656)
Chipinge	-0.107	0.192	-0.745	-0.0112	-0.377**
	(0.193)	(0.194)	(0.740)	(0.218)	(0.171)
Gweru	-0.121	0.164	-0.371	-0.0948	-0.288
	(0.161)	(0.145)	(0.474)	(0.186)	(0.175)
Harare	-0.0458	0.227	-0.808	0.0384	-0.226
	(0.178)	(0.193)	(0.645)	(0.199)	(0.195)
Bulawayo	-0.0242	-0.0972	3.509	-0.0185	-0.124
	(0.257)	(0.247)	(3.428)	(0.226)	(0.213)
Constant	4.614***	3.806***	6.405**	3.726***	4.864***
	(0.478)	(0.618)	(3.149)	(0.483)	(0.442)
Observations	77	77	77	77	77
R-squared	0.099	0.096	0.091	0.095	0.164

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regression analysis results presented in Table 5.11 above show that government policies had no genuine effect on the dependent variables. Tobit analysis results shown in Appendix IV confirm the same findings. Government policy in Zimbabwe is inadequate to have any effect on dairy farmers. Where policies are in place political interference is a major hindrance to policy implementation (Mudimu 2003: 5).

Table 5:12 OLS estimates of impact of political interference on job losses, food security, depletion of dairy herd, hindrance to growth and milk

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Political interference	0.386*	0.248	-0.201	0.119	0.233*
	(0.199)	(0.229)	(0.648)	(0.153)	(0.120)
Gender	0.122	0.316	1.481	0.304***	-0.0147
	(0.130)	(0.208)	(1.082)	(0.0768)	(0.150)
Age	-0.0938	-0.0897	-0.397	0.0316	-0.0409
	(0.0616)	(0.0695)	(0.378)	(0.0493)	(0.0522)
Level of education	-0.152*	-0.143	-0.551	-0.0618	0.0270
	(0.0787)	(0.115)	(0.461)	(0.0851)	(0.0763)
Experience in dairy	-0.0751	0.0386	1.139	-0.0500	-0.153***
	(0.0687)	(0.0921)	(1.092)	(0.0758)	(0.0552)
Chipinge	-0.163	0.138	-0.553	-0.0405	-0.401**
	(0.185)	(0.200)	(0.615)	(0.215)	(0.159)
Gweru	-0.0786	0.163	-0.158	-0.102	-0.230
	(0.161)	(0.161)	(0.396)	(0.187)	(0.173)
Harare	-0.0522	0.176	-0.442	0.00121	-0.161
	(0.161)	(0.186)	(0.423)	(0.193)	(0.182)
Bulawayo	-0.0178	-0.101	3.562	-0.0231	-0.104
	(0.194)	(0.220)	(3.491)	(0.217)	(0.197)
Constant	3.601***	3.469***	4.183	3.636***	3.981***
	(0.795)	(0.969)	(2.731)	(0.698)	(0.565)
Observations	78	78	78	78	78
R-squared	0.243	0.129	0.087	0.105	0.226

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.12 above illustrates that the independent variable unethical government practices significantly affect job losses (0.386*) and milk productivity (0.233*). Tobit model test results in Appendix V confirm that showing the robustness of the model. These findings are in agreement with previous studies. Zimbabwe Human Rights NGOs Forum (2010: 1) argues that the land grabs that took place in 2000 to 2008 have been detrimental to the agricultural sector resulting in productivity going down dramatically. The dairy sector was also negatively affected by the land reform programme as dairy commercial farmers lost their farms reducing the dairy herd by 50% from what it was before the land reform programme in 2000 (Mzumara 2012: 41). This resulted in a total of 224 000 jobs lost on large-scale commercial farms between 2000 and 2010 (Hawkins 2013: [1]).The land invasion and continued insecurity on the farms make it less conducive for dairy farmers to invest and expand their operations, resulting in milk quantity as well as quality significantly declining (Marecha 2009: 14). Farmers are unwilling to engage in long term investments in dairy farming owing to the short term leases offered to the white commercial farmers. Hahlani and Garwi (2014: 93) concurs that dairy operations are affected by insecurity of land tenure. Most able bodied people have migrated from the dairy farms to cities to search for jobs or join the informal sector. The failure by the Zimbabwe government to observe rule of law has created a very hostile environment for commercial farmers to partake in positive agricultural growth (Zimbabwe Human Rights NGOs Forum 2010: 1). This finding concurs with findings by Rukuni (1994) cited in Anseeuw *et al.* (2012: 69) who postulates that institutional vagueness, over centralisation of decision making processes and lack of the land reform programme coordination has contributed to the failure of the agricultural sector.

Table 5:13 : OLS estimates of impact of drought on job losses, food security, depletion of dairy herd, hindered growth and quality of milk

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Drought	0.0960	-0.0747	0.772	0.226***	0.0435
	(0.108)	(0.100)	(0.815)	(0.0783)	(0.115)
Gender	0.0526	0.302	1.329	0.238***	-0.0534
	(0.140)	(0.218)	(0.943)	(0.0838)	(0.180)
Age	-0.0706	-0.0660	-0.462	0.0261	-0.0259
	(0.0622)	(0.0681)	(0.414)	(0.0505)	(0.0536)
Level of education	-0.0562	-0.0990	-0.492	-0.00649	0.0830
	(0.0681)	(0.0968)	(0.372)	(0.0814)	(0.0722)
Experience in dairy	-0.104	0.0137	1.192	-0.0496	-0.171**
	(0.0923)	(0.112)	(1.130)	(0.0783)	(0.0689)
Chipinge	-0.0593	0.105	-0.00684	0.135	-0.349**
	(0.209)	(0.213)	(0.629)	(0.212)	(0.170)
Gweru	-0.289	0.217	-1.189	-0.440**	-0.337
	(0.229)	(0.190)	(1.242)	(0.179)	(0.255)
Harare	-0.264	0.269	-1.713	-0.394*	-0.265
	(0.253)	(0.241)	(1.534)	(0.201)	(0.262)
Bulawayo	-0.221	0.0336	2.066	-0.468*	-0.198
	(0.393)	(0.346)	(2.279)	(0.241)	(0.336)
Constant	4.760***	4.565***	1.455	3.484***	4.719***
	(0.496)	(0.442)	(3.537)	(0.424)	(0.417)
Observations	78	78	78	78	78
R-squared	0.100	0.083	0.091	0.155	0.163

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The beta coefficient of drought (0.226***) to the dependent variable, hindrance of growth in dairy, is statistically significant as shown in Table 5.13, implying that the existence of drought in Zimbabwe increased dairy players' failure to grow their businesses holding all the other independent variables constant. This is confirmed by the Tobit model results in Appendix VI showing the robustness of the model. The findings concur with Manyeruke *et al.* (2013: 271) who argue that it is difficult to sustain viable agriculture when the most important natural resource, water, is depleted. According to The World Bank (2011: 15), increased frequency and severity of drought has undermined milk production because of the lack of water and natural pastures.

Table 5:14 OLS estimates of impact of cattle diseases on job losses, food security, depletion of dairy herd, hindrance to growth and milk

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cattle disease	0.126	0.343	-2.757	0.207	0.0173
	(0.188)	(0.206)	(2.693)	(0.140)	(0.148)
Gender	0.0760	0.289	1.472	0.292***	-0.0433
	(0.132)	(0.199)	(1.126)	(0.0817)	(0.170)
Age	-0.0700	-0.0857	-0.293	0.0317	-0.0239
	(0.0617)	(0.0711)	(0.345)	(0.0504)	(0.0515)
Level of education	-0.0587	-0.0616	-0.816	-0.0197	0.0787
	(0.0691)	(0.0949)	(0.648)	(0.0820)	(0.0731)
Experience in dairy	-0.120	-0.0149	1.414	-0.0796	-0.174**
	(0.104)	(0.111)	(1.323)	(0.0783)	(0.0719)
Chipinge	-0.143	0.123	-0.276	-0.0523	-0.382**
	(0.187)	(0.169)	(0.649)	(0.226)	(0.166)
Gweru	-0.155	0.116	-0.141	-0.125	-0.277
	(0.164)	(0.133)	(0.505)	(0.184)	(0.171)
Harare	-0.114	0.113	-0.170	-0.0329	-0.193
	(0.173)	(0.173)	(0.580)	(0.193)	(0.188)
Bulawayo	-0.0909	-0.266	4.809	-0.121	-0.121
	(0.309)	(0.307)	(4.584)	(0.227)	(0.229)
Constant	4.524***	3.060***	14.00	3.276***	4.765***
	(0.744)	(0.949)	(9.486)	(0.635)	(0.636)
Observations	78	78	78	78	78
R-squared	0.099	0.130	0.120	0.116	0.161

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.14 presents OLS estimates of the impact of cattle diseases on job loss, food insecurity, depletion of dairy herd, hindrance to growth and milk productivity. The results show cattle diseases do not have significant influence on the dependent variables. The findings concurred with a report by (SADC and UNOCHA 2015: [1]) in which cattle diseases were dominant in Matabeleland South (Gwanda), Midlands (Gokwe) and Masvingo provinces and parts of Manicaland (Chipinge South) and Mashonaland West (Ngezi). These areas are outside the delimitation of this study.

Table 5:15 OLS estimates of impact of cyclones on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cyclones	0.186	0.198	0.333	-0.0928	0.0768
	(0.191)	(0.171)	(0.653)	(0.137)	(0.138)
Gender	0.0859	0.297	1.526	0.284***	-0.0388
	(0.129)	(0.210)	(1.112)	(0.0737)	(0.169)
Age	-0.0701	-0.0768	-0.423	0.0435	-0.0255
	(0.0579)	(0.0668)	(0.399)	(0.0502)	(0.0517)
Level of education	-0.0792	-0.100	-0.613	-0.0311	0.0730
	(0.0718)	(0.104)	(0.481)	(0.0807)	(0.0723)
Experience in dairy	-0.0942	0.0324	1.182	-0.0673	-0.167**
	(0.0833)	(0.103)	(1.139)	(0.0796)	(0.0650)
Chipinge	-0.248	0.0331	-0.783	0.0292	-0.430**
	(0.187)	(0.208)	(0.924)	(0.223)	(0.169)
Gweru	0.118	0.405	0.374	-0.263	-0.163
	(0.373)	(0.269)	(1.003)	(0.268)	(0.292)
Harare	0.224	0.492	0.171	-0.178	-0.0559
	(0.438)	(0.313)	(1.121)	(0.315)	(0.355)
Bulawayo	0.278	0.220	4.129	-0.184	0.0155
	(0.370)	(0.280)	(4.359)	(0.285)	(0.313)
Constant	4.346***	3.667***	2.265	4.399***	4.557***
	(0.781)	(0.600)	(3.503)	(0.576)	(0.599)
Observations	78	78	78	78	78
R-squared	0.113	0.099	0.087	0.094	0.165

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.15 indicate that cyclones did not have a significant impact on all the dependent variables. Cyclones do not frequently occur in Zimbabwe, with notable cyclones only occurring in 2000 and 2003 rocking Zambezi basin's Guruve and Muzarabani districts (Madamombe 2004: 1-2), areas that are outside the delimitation of this study.

Table 5:16 OLS estimates of impact of extreme cold weather on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cold extreme weather	0.0157	0.0632	0.511	0.118	-0.0285
	(0.0826)	(0.0786)	(0.521)	(0.0761)	(0.0873)
Gender	0.0695	0.265	1.341	0.252***	-0.0344
	(0.137)	(0.219)	(1.000)	(0.0888)	(0.166)
Age	-0.0647	-0.0719	-0.421	0.0387	-0.0227
	(0.0613)	(0.0674)	(0.408)	(0.0513)	(0.0522)
Level of education	-0.0703	-0.0951	-0.642	-0.0473	0.0799
	(0.0726)	(0.101)	(0.479)	(0.0781)	(0.0754)
Experience in dairy	-0.107	0.0247	1.216	-0.0464	-0.176**
	(0.0926)	(0.108)	(1.132)	(0.0792)	(0.0686)
Chipinge	-0.110	0.237	0.0546	0.114	-0.415**
	(0.208)	(0.191)	(0.673)	(0.204)	(0.189)
Gweru	-0.171	0.0524	-0.607	-0.239	-0.250
	(0.192)	(0.173)	(0.635)	(0.180)	(0.203)
Harare	-0.115	0.0944	-0.811	-0.105	-0.169
	(0.188)	(0.185)	(0.653)	(0.185)	(0.211)
Bulawayo	-0.0430	-0.148	3.281	-0.0947	-0.0974
	(0.288)	(0.270)	(3.294)	(0.230)	(0.228)
Constant	4.963***	4.187***	1.960	3.725***	4.914***
	(0.439)	(0.368)	(2.558)	(0.372)	(0.426)
Observations	78	78	78	78	78
R-squared	0.091	0.084	0.090	0.119	0.163

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The independent variable of cold extreme weather in Table 5.16 does not significantly affect the dependent variables. However, robustness check with results displayed in Appendix IX shows that this could significantly affect the depletion of dairy cows. An increase in sample size can result in significant changes. However, the insignificance of extreme cold weather is consistent with results of Yeboah *et al.* (2014: 39) whereby the Ghana agricultural supply chain was not influenced by extreme cold weather.

Table 5:17 OLS estimates of impact of feeds processing technology on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Feed processing	0.0197	0.0651	-0.387	0.0685	0.0476
	(0.131)	(0.0829)	(0.812)	(0.0722)	(0.0815)
Gender	0.0739	0.283	1.517	0.287***	-0.0449
	(0.132)	(0.208)	(1.093)	(0.0779)	(0.168)
Age	-0.0642	-0.0699	-0.418	0.0416	-0.0225
	(0.0611)	(0.0686)	(0.384)	(0.0514)	(0.0528)
Level of education	-0.0673	-0.0839	-0.626	-0.0308	0.0811
	(0.0713)	(0.101)	(0.477)	(0.0818)	(0.0761)
Experience in dairy	-0.109	0.0146	1.172	-0.0629	-0.175**
	(0.0957)	(0.111)	(1.111)	(0.0820)	(0.0692)
Chipinge	-0.127	0.168	-0.618	-0.0216	-0.375**
	(0.194)	(0.190)	(0.668)	(0.220)	(0.165)
Gweru	-0.152	0.127	-0.199	-0.112	-0.267
	(0.163)	(0.145)	(0.460)	(0.183)	(0.172)
Harare	-0.0998	0.155	-0.483	-0.00254	-0.183
	(0.168)	(0.172)	(0.474)	(0.188)	(0.186)
Bulawayo	-0.0315	-0.103	3.518	-0.0190	-0.107
	(0.263)	(0.255)	(3.435)	(0.225)	(0.210)
Constant	4.921***	4.084***	5.166	3.765***	4.620***
	(0.693)	(0.638)	(3.288)	(0.530)	(0.568)
Observations	78	78	78	78	78
R-squared	0.091	0.082	0.088	0.094	0.164

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The study also reveals no statistically significant impact of feeds processing on the dependent variables (see Table 5.17). The Tobit model also reveals that feeds processing had no impact on job losses, food insecurity, depletion of dairy herd, hindrance to growth of dairy enterprises and milk productivity. Most of the dairy cattle farmers in Zimbabwe do not process feed but depend on natural pasture as reported in previous research (Masama 2013: 49).

Table 5:18 OLS estimates of impact of milking and packaging equipment on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Milking and Packaging technology	0.153	0.286	-0.925	0.136	0.312**
	(0.229)	(0.207)	(1.140)	(0.160)	(0.125)
Gender	0.0834	0.302	1.452	0.297***	-0.0254
	(0.130)	(0.199)	(1.039)	(0.0753)	(0.170)
Age	-0.0698	-0.0808	-0.380	0.0359	-0.0340
	(0.0614)	(0.0687)	(0.366)	(0.0511)	(0.0537)
Level of education	-0.0737	-0.0981	-0.565	-0.0406	0.0675
	(0.0707)	(0.0972)	(0.426)	(0.0812)	(0.0701)
Experience in dairy	-0.0923	0.0474	1.059	-0.0459	-0.140**
	(0.0815)	(0.0959)	(1.010)	(0.0771)	(0.0624)
Chipinge	-0.152	0.118	-0.435	-0.0500	-0.426***
	(0.182)	(0.190)	(0.543)	(0.218)	(0.160)
Gweru	-0.166	0.0933	-0.0546	-0.136	-0.298*
	(0.157)	(0.148)	(0.388)	(0.177)	(0.157)
Harare	0.243	0.790	-2.508	0.293	0.514
	(0.533)	(0.495)	(2.671)	(0.389)	(0.357)
Bulawayo	-0.0658	-0.171	3.762	-0.0563	-0.178
	(0.283)	(0.272)	(3.670)	(0.219)	(0.195)
Constant	4.371***	3.179***	7.312*	3.502***	3.529***
	(0.939)	(0.894)	(4.258)	(0.719)	(0.601)
Observations	78	78	78	78	78
R-squared	0.106	0.122	0.091	0.102	0.238

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Data from Table 5.18 illustrates that there is a statistically significant impact of the independent variable, milk and packaging technology and the dependent variable, milk productivity. Milking and packaging technology had a beta value of 0.312** implying a statistically significant relationship at 5% level of significance. The results are consistent with the results of the Tobit model in Appendix XI showing the robustness of the model. This result indicates that and investment in dairy technology results in an increase in productivity. This is confirmed by previous researchers such as Nyamwanza *et al.* (2015: 7) who argue that poor technology has adversely affected capacity utilization in the milk processing industry. Capacity utilization has gone down owing to use of outdated equipment. This observation is supported by findings by ZimVAC (2009: 2) which stated that low productivity in Zimbabwe's dairy industry is related to the low level of capital endowment which in turn makes it difficult to employ productive farm technologies leading to low yields. Hahlani and Garwi (2014: 90) also attest that the dairy industry is naturally capital intensive. The prevailing liquidity crunch has forced dairy farmers and producers to operate below normal capacity leading to low milk output.

Table 5:19 OLS estimates of impact of power outages on job losses, food security, depletion of dairy herd, hindered growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Power outages	0.0502	0.174	2.467	0.285*	0.365***
	(0.168)	(0.186)	(2.223)	(0.153)	(0.133)
Gender	0.0663	0.257	1.104	0.243***	-0.103
	(0.136)	(0.199)	(0.776)	(0.0789)	(0.155)
Age	-0.0625	-0.0639	-0.314	0.0520	-0.00851
	(0.0624)	(0.0720)	(0.313)	(0.0485)	(0.0503)
Level of education	-0.0648	-0.0751	-0.395	-0.0133	0.107
	(0.0696)	(0.0988)	(0.338)	(0.0792)	(0.0674)
Experience	-0.105	0.0274	1.300	-0.0436	-0.152**
	(0.0914)	(0.106)	(1.216)	(0.0760)	(0.0641)
Chipinge	-0.124	0.179	-0.294	0.00178	-0.340**
	(0.193)	(0.194)	(0.628)	(0.205)	(0.167)
Gweru	-0.151	0.131	0.144	-0.0960	-0.238
	(0.161)	(0.145)	(0.638)	(0.178)	(0.174)
Harare	-0.104	0.142	-0.436	-0.0168	-0.194
	(0.168)	(0.172)	(0.569)	(0.185)	(0.185)
Bulawayo	-0.0478	-0.159	2.896	-0.106	-0.213
	(0.289)	(0.290)	(2.872)	(0.228)	(0.214)
Constant	4.778***	3.572***	-7.892	2.759***	3.151***
	(0.797)	(1.027)	(11.55)	(0.733)	(0.628)
Observations	78	78	78	78	78
R-squared	0.092	0.092	0.114	0.144	0.250

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.19 shows significant impact of power outages in the dairy industry on firm growth and milk productivity with beta values of 0.285* and 0.365*** respectively. Tobit model results on Appendix XII confirm the robustness of the results as it shows the same significance. Erratic power supply causes significant problems to the Uganda dairy supply chain, leading to long equipment breakdown time, idle capacity utilization, low-capacity utilization and high costs to supplement electricity (The World Bank 2011: 15).

Table 5:20 OLS estimates of impact of labour costs on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
High labor costs	0.0708	0.145	1.968	0.170*	0.00452
	(0.121)	(0.110)	(2.119)	(0.0854)	(0.129)
Gender	0.0876	0.312	1.869	0.321***	-0.0427
	(0.135)	(0.213)	(1.458)	(0.0858)	(0.174)
Age	-0.0692	-0.0805	-0.544	0.0293	-0.0234
	(0.0612)	(0.0684)	(0.491)	(0.0510)	(0.0525)
Level of education	-0.0709	-0.0932	-0.650	-0.0411	0.0771
	(0.0716)	(0.0976)	(0.531)	(0.0814)	(0.0747)
Experience	-0.103	0.0278	1.300	-0.0478	-0.173**
	(0.0936)	(0.108)	(1.202)	(0.0818)	(0.0697)
Chipinge	-0.133	0.152	-0.673	-0.0391	-0.381**
	(0.192)	(0.193)	(0.751)	(0.220)	(0.165)
Gweru	-0.156	0.112	-0.130	-0.127	-0.277
	(0.161)	(0.142)	(0.452)	(0.182)	(0.170)
Harare	-0.0883	0.174	-0.00153	0.0214	-0.190
	(0.169)	(0.173)	(0.609)	(0.189)	(0.187)
Bulawayo	-0.0536	-0.152	3.028	-0.0751	-0.115
	(0.270)	(0.267)	(2.892)	(0.222)	(0.215)
Constant	4.864***	4.076***	-0.570	3.720***	4.822***
	(0.499)	(0.540)	(5.582)	(0.397)	(0.458)
Observations	78	78	78	78	78
R-squared	0.094	0.093	0.113	0.118	0.161

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Table 5.20 high labour costs, with a beta value of 0.170*, in dairy industry in Zimbabwe have a significant impact on hindering growth of dairy businesses. This is also evident from the Tobit model results in Appendix XIII showing the robustness of the model. This is in concurrence with results of a study on the viability of small dairying in Wedza, Zimbabwe where increases in total variable and labour costs reduced returns and income could not cover costs (Zvinorova *et al*. 2013: 1007-15).

Table 5:21 OLS estimates of impact of cost of breeding on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food insecurity	(3) Depletion of herd	(4) Hindered growth	(5) Reduced Productivity
Cost breed	0.504**	0.393*	-2.553	0.0963	0.104
	(0.208)	(0.228)	(2.558)	(0.171)	(0.168)
Gender	0.0711	0.283	1.523	0.289***	-0.0442
	(0.139)	(0.199)	(1.134)	(0.0770)	(0.168)
Age	-0.0422	-0.0535	-0.525	0.0449	-0.0185
	(0.0613)	(0.0690)	(0.459)	(0.0528)	(0.0540)
Level of education	-0.0847	-0.102	-0.514	-0.0393	0.0740
	(0.0722)	(0.103)	(0.398)	(0.0829)	(0.0743)
Experience	-0.0910	0.0308	1.068	-0.0569	-0.169**
	(0.0926)	(0.105)	(1.010)	(0.0809)	(0.0675)
Chipinge	-0.0162	0.248	-1.144	-0.00851	-0.357**
	(0.163)	(0.218)	(1.092)	(0.224)	(0.165)
Gweru	-0.0363	0.206	-0.725	-0.103	-0.252
	(0.158)	(0.183)	(0.756)	(0.187)	(0.169)
Harare	0.0561	0.267	-1.223	0.0160	-0.158
	(0.159)	(0.211)	(0.981)	(0.199)	(0.190)
Bulawayo	-0.0860	-0.152	3.834	-0.0381	-0.124
	(0.248)	(0.260)	(3.705)	(0.225)	(0.211)
Constant	2.720***	2.588**	15.04	3.631***	4.358***
	(0.983)	(1.197)	(10.53)	(0.853)	(0.831)
Observations	78	78	78	78	78
R-squared	0.188	0.126	0.106	0.091	0.166

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results in Table 5.21 indicate that cost of breeding dairy herd significantly impact on job losses and food insecurity. This result is confirmed by Tobit model in Appendix XIV. Therefore, an increase in cost of breeding dairy cows contributes in increasing job losses and food insecurity. The study confirmed that dairy farmers faced dairy production constraints in high costs to breed or purchase cross breed heifers (Hahlani and Garwi 2014: 90).

5.6 Overall effect of disaster risks on job losses, food security, depletion of dairy herd, hindered growth of dairy firms and quantity and quality of milk

This researcher tested for an overall effect of disaster risks on job losses, food security, depletion of dairy herd, hindered growth of dairy firms and quantity and quality of milk using OLS analysis. The overall disaster risk index included 14 disaster risks that are interest rates, influence from local giants, international competition, government policy, political influence drought, cattle diseases, cyclones, extreme cold weather, feeds processing technology, power outages, milk technology, high labour costs and cost of breeding dairy herd.

Table 5:22 OLS estimates of impact of disaster risks on job losses, food security, depletion of dairy herd, hindrance growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food insecurity	(3) Depletion of herd	(4) Hindered growth	(5) Reduced Productivity
Disaster risks	0.0797*	0.0903**	0.0260	0.0525**	0.0413*
	(0.0409)	(0.0375)	(0.126)	(0.0252)	(0.0247)
Gender	0.133	0.337	1.611	0.330***	-0.00752
	(0.151)	(0.205)	(1.170)	(0.102)	(0.169)
Age	-0.104	-0.114	-0.431	0.0147	-0.0438
	(0.0627)	(0.0689)	(0.402)	(0.0519)	(0.0520)
Level of education	-0.112	-0.130	-0.656	-0.0659	0.0520
	(0.0851)	(0.100)	(0.501)	(0.0860)	(0.0724)
Experience	-0.0695	0.0697	1.121	-0.0359	-0.156**
	(0.0735)	(0.0861)	(1.070)	(0.0773)	(0.0589)
Chipinge	-0.103	0.188	-0.553	-0.0126	-0.366**
	(0.168)	(0.176)	(0.620)	(0.220)	(0.156)
Gweru	0.0879	0.391**	-0.0492	0.0340	-0.151
	(0.204)	(0.188)	(0.501)	(0.201)	(0.180)
Harare	0.416	0.731**	-0.245	0.327	0.0776
	(0.320)	(0.290)	(0.889)	(0.258)	(0.236)
Bulawayo	0.0850	-0.00265	3.755	0.0540	-0.0428
	(0.214)	(0.200)	(3.628)	(0.206)	(0.190)
Constant	1.450	0.308	2.473	1.731	2.999**
	(1.810)	(1.749)	(5.944)	(1.203)	(1.159)
Observations	77	77	77	77	77
R-squared	0.237	0.214	0.090	0.168	0.214

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regression analysis tests have been instrumental in analyzing the data and inferring from it. The regression analyses done to find out the impact of disaster risks on dairy supply chains in Zimbabwe revealed a significant impact of disaster risks on job losses, food security, hindered growth of dairy business and milk productivity. From Table 5.22 it can be seen that the overall effect of disaster risks on job losses, food insecurity, hindrance to milk business growth and productivity in milk is statistically significant. With beta values of 0.0797* (job losses), 0.0903** (food security), 0.0525** (hindrance to growth) and 0.0413* (milk productivity), significant at 0.01 or 0.1 level, disaster risks impact significantly on the dairy supply chains in Zimbabwe. Column 1 of Table 5.22 imply that increased incurrence of disaster risks results in increase in job losses in dairy supply chains. According to the Commercial Framers' union (2010) the hazards disrupt the supply chain in the country leading to collapse of some firms. Column 2 of Table 5.22 confirm that increase in disaster risks in dairy industry leads to food insecurity as shown by beta coefficient of 0.0903**. Increased incidences and severity of disaster risks hinders growth of dairy business enterprises. Disaster risks in Bangladesh resulted in devastating losses to firms within the dairy supply chain (ANZAM 2014: 13). In the same manner increase in incidence and severity of disaster risks leads to reduced productivity in milk and milk products. The results are consistent with those by previous researchers (Anseeuw *et al.* 2012: 27) where they attribute the fall in dairy contribution to GDP to disruption of the dairy supply chain.

5.7 Collaborative strategies

Table 5:23 Collaborative strategies in use by region

Variable	Chipinge		Gweru		Harare		Bulawayo		Mutare		Total	
Collaborative Strategies	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Agriculture	4.1	4.0	4.1	4.0	4.3	4.0	4.0	4.0	4.0	4.0	4.1	4.0
Education	2.0	2.0	2.2	2.0	2.0	2.0	2.1	2.0	2.0	2.0	2.1	2.0
Environment	4.2	4.0	4.2	4.0	4.2	4.0	4.2	4.0	4.0	4.0	4.2	4.0
Cooperatives	4.1	4.0	4.1	4.0	4.0	4.0	3.9	4.0	4.1	4.0	4.0	4.0
NGOs	3.9	4.0	3.9	4.0	4.1	4.0	2.9	2.5	4.2	4.0	3.8	4.0

Source: Primary data

Table 5.23 indicates the collaborative strategies in use in the dairy sector. Government departments of Agriculture and Environment also participate in disaster reduction as there is a mean response of 4.0 implying agreement from respondents on the presence of collaboration. Interviews with dairy authorities confirmed that training programmes were conducted by officers from the livestock production department targeting small scale farmers while large-scale commercial farmers pay a fee for accessing training. The Dairy Services and Veterinary services are responsible for disaster risk reduction throughout regions covered by this research. Awareness programmes on veld fires were also regularly conducted to reduce the depletion of pastures.

NGOs were involved in disaster risk reduction in most regions as evidenced by mean response of 4.0 except in Bulawayo region where respondents cited limited NGO collaboration. Findings from interviews with dairy officers show cases of planned coordination by stakeholders in the industry to reduce the negative effects of disaster risks across the supply chain. FAO distributed drugs to vaccinate dairy cows in Gweru through the department of livestock, which falls under the Ministry of Agriculture, Mechanization and Irrigation Development. Large-scale commercial dairy farmers also benefited from a European Union (EU) assisted grant to import Heifers. Under this programme, the EU facilitated the creation of strategic linkages between low cost micro financers and farmers. This scheme requires farmers to folk out 10 % deposit, and have a milk processor as a guarantor.

All dairy officers in regions under study concurred on the existence of collaboration among NGOs, government departments and ZADF. Firstly, in Chipinge dairy farmers are working in collaboration with Dairy Services, ZADF and other NGOs under the (Dairy Revitalization Scheme) which is designed to support small scale dairy farmers. The assistance provided to commercial dairy farmers by the government in the region requires farmers to meet laid down criteria which comprises of following conditions: having adequate feeds, having developed dairy infrastructure, firm milk supply contracts with processors, milk production records and considerable experience in dairy farming.
In Gweru, there are capacity building programmes also run by NGOs, particularly SNV. This organisation is funding the purchase of packaging, testing machines and automatic sealers for small holder farmers based in Boterekwa, Tongogara and Gokwe areas. Processors in this region have partnered with small scale dairy farmers by providing low cost feeds to enable the lowering of prices across the dairy supply chain. Farmers in the region have benefitted from the Dairy Revitalization Revolving Fund which has enabled processors to buy Heifers and distribute them to dairy farmers. These farmers are expected to pay a 20 % deposit before benefitting from the programme. The balance is payable in monthly instalments.

In the Mutare region, Dairiboard Zimbabwe Limited, a dairy processor, supports the region by distributing heifers to small scale dairy farmers in the region. The government in collaboration with other NGOs is funding SMEs workshops for dairy farmers in the area. Small scale farmers do collective marketing through their MCCs. NGOs and Zimplats, a leading mining company, are some of the organizations engaging in corporate social philanthropy by funding dairy development programmes. Farmers benefit from such schemes as communities and not as individuals. The participation of NGOs in collaboration with other stakeholders in dairy programmes is in agreement with Mbowa (2010: 192) recommendation that WFP in Zimbabwe should collaborate with the corporate world and the military to improve efficiency and effectiveness in disaster risk awareness.

Ministry of Agriculture extension workers have also been assisting dairy farmers with technical expertise on how to run their dairies viably as well as efficiently. Dairy services officers periodically collect milk samples from farmers to check for conformity to quality and standards set out by the Dairy Act in order to protect consumers. These measures are guided by the Dairy Services Act which ensures that regulatory standards are followed (Dairy Services Act of 2001, section 19). There is continuous inspection of dairy parlours and milk processing plants by the dairy unit.

The ZADF lobbies for dairy farmers. Efforts are being made to lobby against the short term 5 year leases as they are retrogressive as far as agricultural production is concerned considering the fact that a dairy cow takes four years to mature. This then defeats the purpose of a long term investment project in dairy farming. The lobbying by dairy farmers for long-term leases was expected considering Marecha (2008: 4) attributed decline in quantity and quality of milk to unconducive land tenure and security of tenure. Success was achieved in lobbying the government to enact legislation to protect the dairy industry from fierce competition, stemming from cheap milk imports. The government under the Statutory Instrument 64 of 2016 discourages importation of dairy products by introducing more stringent import restrictions which make it a requirement for retailers to acquire import licenses for dairy products. A local lobby

organization, Buy Zimbabwe which advocates for the buying of local products has also worked closely with retailers in its advocacy programmes. These findings are in line with recommendations by Nyamwanza *et al*. (2015: 8) that stakeholders should lobby for government to protect Zimbabwe's dairy sector from cheap imports.

5.8 Impact of collaborative strategies

Table 5:24 Impact of collaborative strategies by experience in dairy

Tenure	Variable	Mean	Median
0-5 years	Impact of collaboration	2.1	2.0
6-10 years	Impact of collaboration	2.2	2.0
11-15 years	Impact of collaboration	2.3	2.0
16 and above	Impact of collaboration	2.4	2.0
Total	Impact of collaboration	2.3	2.0

Source: Primary data

A mean of 2.1 and 2.2 for 0-5 and 6-10 years in Table 5.24 on a 6-point Likert scale for effectiveness of collaborative strategies indicates that the respondents who were new in the dairy industry did not gain much from collaboration strategies in dairy supply chains as compared to experienced farmers. These results concur with Makamure *et al.* (2001: 8) on the view that it is not easy for new dairy players to enter the dairy market.

Table 5:25 OLS estimates for the impact of NGOs on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
NGOs	-0.106	-0.0364	0.120	0.0542
	(0.153)	(0.126)	(0.163)	(0.125)
Gender	-0.115	-0.303	0.136	0.327
	(0.372)	(0.245)	(0.241)	(0.259)
Age	0.0243	-0.174*	-0.156	-0.131
	(0.123)	(0.103)	(0.100)	(0.0963)
Level of education	-0.162	-0.0363	-0.0317	-0.124
	(0.162)	(0.0990)	(0.132)	(0.111)
Experience	0.0508	0.0789	-0.192	-0.173
	(0.154)	(0.100)	(0.115)	(0.107)
Chipinge	0.310	-0.0676	0.0533	0.332
	(0.454)	(0.283)	(0.410)	(0.388)
Gweru	-0.313	-0.0205	0.272	0.0752
	(0.419)	(0.246)	(0.373)	(0.362)
Harare	0.00124	0.289	0.117	0.0664
	(0.439)	(0.259)	(0.357)	(0.338)
Bulawayo	-0.227	0.0383	-0.416	0.166
	(0.487)	(0.244)	(0.360)	(0.379)
Constant	3.060***	3.410***	3.555***	3.194***
	(0.853)	(0.743)	(0.859)	(0.731)
Observations	79	79	79	79
R-squared	0.066	0.140	0.156	0.105

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Findings of this study presented in Table 5.25 reveal no significant impact of NGOs on dairy supply chain performance. Collaboration among government, private sector and NGOs require that government provide an enabling environment (Forbes 2010: 13) to have a successful private-public partnership. The functionality of NGOs in Zimbabwe is stifled by unfriendly government policies (Brown *et al.* 2012: 19).

Table 5:26 OLS estimates of the impact of collaboration with Agriculture ministry on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Agriculture	-0.685**	0.408	0.121	0.0491
	(0.276)	(0.250)	(0.318)	(0.257)
Gender	-0.172	-0.227	0.103	0.311
	(0.375)	(0.249)	(0.241)	(0.247)
Age	-0.0129	-0.164	-0.137	-0.122
	(0.114)	(0.0999)	(0.0998)	(0.0956)
Level of education	-0.198	-0.0293	-0.0101	-0.115
	(0.166)	(0.101)	(0.132)	(0.109)
Experience	0.0905	0.0546	-0.198*	-0.176
	(0.147)	(0.0993)	(0.113)	(0.111)
Chipinge	0.370	-0.0789	0.0179	0.316
	(0.438)	(0.279)	(0.406)	(0.383)
Gweru	-0.263	-0.0274	0.239	0.0606
	(0.387)	(0.228)	(0.366)	(0.359)
Harare	0.160	0.199	0.0840	0.0527
	(0.417)	(0.240)	(0.346)	(0.334)
Bulawayo	-0.0548	0.0566	-0.569	0.0971
	(0.412)	(0.235)	(0.344)	(0.354)
Constant	5.581***	1.550	3.473**	3.181**
	(1.405)	(1.257)	(1.484)	(1.329)
Observations	79	79	79	79
R-squared	0.128	0.177	0.151	0.103

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results presented in Table 5.26 show that collaboration with the Ministry of Agriculture has a significant impact on supply chain costs. The results imply that increased collaborative efforts with the Ministry of Agriculture led to a reduction in dairy supply chain costs. Tobit model results presented in Appendix XVI confirm the results showing a robust model. These results are consistent with the objectives of Land O'Lakes partnership with NADF and Ministry of Agriculture to train dairy farmers on the Accounting Bureau System to improve levels of financial management (Land O'Lakes 2014: [1]).

Table 5:27 OLS estimates of the impact of collaboration with Education ministry on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Education	-0.0227	-0.0680	0.101	0.195
	(0.167)	(0.130)	(0.169)	(0.180)
Gender	-0.0694	-0.285	0.0808	0.296
	(0.371)	(0.252)	(0.244)	(0.248)
Age	0.00935	-0.185*	-0.131	-0.104
	(0.125)	(0.102)	(0.0992)	(0.0930)
Level of education	-0.180	-0.0504	-0.000902	-0.0912
	(0.165)	(0.0972)	(0.127)	(0.107)
Experience	0.0553	0.0940	-0.214*	-0.217*
	(0.157)	(0.107)	(0.127)	(0.114)
Chipinge	0.333	-0.0679	0.0376	0.345
	(0.455)	(0.285)	(0.404)	(0.375)
Gweru	-0.285	-0.00257	0.230	0.0357
	(0.418)	(0.244)	(0.374)	(0.364)
Harare	0.00468	0.286	0.119	0.0779
	(0.437)	(0.259)	(0.357)	(0.332)
Bulawayo	-0.0943	0.0948	-0.580	0.0650
	(0.445)	(0.250)	(0.353)	(0.355)
Constant	2.730***	3.429***	3.763***	2.961***
	(0.783)	(0.713)	(0.678)	(0.691)
Observations	79	79	79	79
R-squared	0.060	0.141	0.153	0.118

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.27 illustrates that collaboration with Ministry of Education had no significant impact on the dependent variables of supply chain costs, lead time, milk sales and milk variety and quality, in the models shown in the table. Sensitivity rest results of the Tobit model, Appendix XVII show no significant impact as well. The findings contradict findings from previous researchers such as Mishra and Shekhar (2012: 88) who recommended education and training to address risks in the dairy food supply chain in India. The existing school curriculum in Zimbabwe did not incorporate extensive and relevant content on disaster risk reduction.

Table 5:28 OLS estimates on the impact of collaboration with environment ministry on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Environment	-0.478**	-0.225	0.114	0.391
	(0.239)	(0.176)	(0.235)	(0.238)
Gender	-0.0646	-0.285	0.0836	0.299
	(0.353)	(0.254)	(0.243)	(0.242)
Age	-0.00138	-0.185*	-0.138	-0.113
	(0.124)	(0.0997)	(0.102)	(0.0950)
Level of education	-0.167	-0.0370	-0.0162	-0.124
	(0.161)	(0.0980)	(0.129)	(0.102)
Experience	0.0230	0.0658	-0.184	-0.151
	(0.148)	(0.100)	(0.114)	(0.108)
Chipinge	0.439	-0.00973	-0.000764	0.234
	(0.434)	(0.326)	(0.406)	(0.372)
Gweru	-0.207	0.0264	0.225	-0.00409
	(0.396)	(0.276)	(0.367)	(0.351)
Harare	0.0780	0.325	0.0941	0.00511
	(0.407)	(0.285)	(0.352)	(0.305)
Bulawayo	-0.0252	0.117	-0.579	0.0404
	(0.417)	(0.280)	(0.347)	(0.338)
Constant	4.702***	4.233***	3.504***	1.735
	(1.106)	(0.831)	(1.235)	(1.307)
Observations	79	79	79	79
R-squared	0.104	0.154	0.152	0.137

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The OLS regression test was done to examine whether there was a significant impact of collaborative relationships with the Ministry of Environment. Results shown in Table 5.28 above show a beta coefficient value of -0.478** implying that increased collaborative efforts with the Ministry of Environment could lead to reduced dairy supply chain costs. The Tobit model on Appendix on XVIII confirms the same relationship has similar results on the supply chain. The finding concurs with expectations of the Zimbabwe Environmental Management Act 13 of 2002, which governs issues to do with sustaining management of resources and protection of the environment (Chagutah 2010: 19).

Table 5:29 OLS estimates on the impact of cooperative association on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Cooperatives	-0.109	0.275*	0.197	0.143
	(0.157)	(0.161)	(0.294)	(0.199)
Gender	-0.0839	-0.254	0.110	0.321
	(0.375)	(0.256)	(0.233)	(0.248)
Age	0.00291	-0.157	-0.125	-0.113
	(0.125)	(0.0947)	(0.105)	(0.0944)
Level of education	-0.169	-0.0625	-0.0288	-0.127
	(0.164)	(0.0984)	(0.130)	(0.107)
Experience	0.0449	0.0919	-0.181	-0.166
	(0.150)	(0.101)	(0.120)	(0.110)
Chipinge	0.331	-0.0473	0.0321	0.325
	(0.456)	(0.277)	(0.404)	(0.383)
Gweru	-0.286	-0.0176	0.240	0.0595
	(0.414)	(0.232)	(0.365)	(0.361)
Harare	-0.0126	0.338	0.145	0.0885
	(0.437)	(0.242)	(0.355)	(0.335)
Bulawayo	-0.110	0.113	-0.539	0.116
	(0.438)	(0.235)	(0.347)	(0.356)
Constant	3.181***	2.021**	3.082*	2.734**
	(0.980)	(0.942)	(1.577)	(1.051)
Observations	79	79	79	79
R-squared	0.063	0.170	0.159	0.109

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results from Table 5.29 column 2 illustrate that cooperative associations in dairy activities have a positive and significant impact on lead time experienced by dairy supply chain stakeholders. A beta coefficient of 0.275* implies that when dairy farmers engage in cooperative associations, lead times for inputs and consumables increase. Tobit estimates obtained and presented in Appendix XIX confirm the robustness of the models in Table 5.29. Milk Collection Centre (MCC) collects milk on trucks from small scale farmers scattered around the MCC instead of individual farmers delivering on foot, bicycles or scotch carts (Kagoro and Chatiza 2012: 24) reducing delivery times.

An index for collaborative strategies was constructed with the variables: sharing information, collaboration with the Agriculture Ministry, collaboration with Education Ministry, collaboration with Environment Ministry and formation of cooperative associations. The index was calculated by summing these desirable variables. To determine the degree of impact of implementing collaborative strategies the collaborative index was regressed against the dependent variables: supply chain costs, lead time, sales and variety and quality of milk. The results are shown in Table 5.30.

Table 5:30 OLS estimates of the impact of collaborative strategies on supply chain costs, lead time, milk sales and milk variety and quality.

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Collaborative strategies	-0.180***	0.0293	0.118	0.136**
	(0.0673)	(0.0834)	(0.0988)	(0.0626)
Gender	-0.187	-0.269	0.161	0.392
	(0.363)	(0.251)	(0.225)	(0.261)
Age	-0.0104	-0.175*	-0.127	-0.107
	(0.120)	(0.101)	(0.0969)	(0.0920)
Level of education	-0.162	-0.0443	-0.0242	-0.128
	(0.163)	(0.0973)	(0.128)	(0.108)
Experience	0.0834	0.0732	-0.213*	-0.198*
	(0.148)	(0.101)	(0.112)	(0.104)
Chipinge	0.308	-0.0541	0.0422	0.340
	(0.445)	(0.280)	(0.394)	(0.365)
Gweru	-0.265	-0.0158	0.228	0.0446
	(0.400)	(0.240)	(0.361)	(0.351)
Harare	0.0209	0.288	0.102	0.0527
	(0.419)	(0.252)	(0.343)	(0.317)
Bulawayo	-0.265	0.110	-0.451	0.227
	(0.425)	(0.227)	(0.337)	(0.346)
Constant	6.064***	2.728*	1.760	0.825
	(1.500)	(1.584)	(2.040)	(1.407)
Observations	79	79	79	79
R-squared	0.111	0.141	0.171	0.137

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results in Table 5.30 show that collaborative strategies in dairy supply chains have a significant impact on supply chain costs and quality and variety of milk and milk products. Column 1 and 4 of Table 5.30 show beta values of -0.180*** and 0.136** for supply chain costs and variety and quality of milk and milk products respectively implying that collaborative efforts reduce supply chain costs as well as increase the quality and quantity of milk and milk products produced. Sensitivity test of the same models show that Tobit estimates in Appendix ix confirm the same results showing the robustness of these models. The Supply Chain Council Risk Research Team (SCCRRT) (2008: 28) concurs with the findings when they explained the need for cooperation among departments in the same organisation and among different organisations in the supply chain to save resources and improve effectiveness. The positive insignificant beta value of collaborative strategies to reduction of lead time contradicts Mbohwa's (2010: 192) claim that collaboration by WFP, private sector and other NGOs by sharing information, systems, resources, and knowledge in radio, satellite, licensing and hardware should improve responsiveness to humanitarian needs.

5.9 Challenges for collaboration

Results of interviews held with dairy authorities concur with the results of the questionnaires administered on challenges encountered in dairy supply chain. Despite collaborative measures being taken to mitigate against disaster, challenges continue to thwart efforts made by the dairy stakeholders in disaster reduction. Results from the questionnaires on challenges hindering collaboration are shown in Table 5.31 below.

Table 5:31 Challenges for collaboration by years of experience

Variable	**0-5 years**		**6-10 years**		**11-15 years**		**16+ years**		**Total**	
Challenges	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Economic situation	4.4	4.0	4.1	4.0	4.1	4.0	4.3	4.0	4.2	4.0
Scepticism	4.4	4.0	4.3	4.0	4.2	4.0	4.2	4.0	4.3	4.0
Lack of training	4.6	5.0	4.4	4.0	4.1	4.0	4.2	4.0	4.3	4.0
Time for collaboration	2.7	2.0	2.7	2.0	3.2	3.0	2.8	2.0	2.9	2.0

Source: Primary data

The Table 5.31 shows that the respondents agreed that supply chain partners were sceptical about each other as indicated by the median value of 4.0.This finding concurs with Brown *et al.* (2012:19) who noted that the Government of Zimbabwe refuses to be associated with countries with low Human Development Index (HDI) making it harder for NGOs to operate effectively. In Darfur region NGOs faced challenges in accessing conflict affected areas because government complicated the procedure to obtain

permission to travel to such areas and to offer health services (Yagub 2014: 570). Murigi (2013: 977) noted that among the bottlenecks Brookside Dairy Ltd of Kenya faced in supply chain risk management was the lack of goodwill from the partners in supply chain management to share crucial information with the organization. Zhou and Zvoushe (2012: 220) state that policies and strategies are disintegrated as stakeholders are not involved in formulating policies and strategies that affect them.

The median value of 4.0 for the variable, lack of training indicates that the respondents agreed that there was lack of training on disaster preparedness among dairy supply chain partners. Findings from interviews with dairy authorities also confirm a general outcry across all the milk producing regions as they all share the same sentiments on resource constraints rendering collaboration ineffective. Government personnel, in Darfur's conflict hit area, lacked knowledge, skills and capacity preventing successful engagement between government and NGOs in collaborative initiatives (Yagub 2014: 570).

Table 5.31 indicates that respondents concur that the economic situation was posing challenges for their dairy operations. Results for interviews highlight that the economic meltdown which affected Zimbabwe from the early 90s leading to the adoption of the multi-currency regime has adversely contributed to the inability of dairy farmers to remain competent. The liquidity crunch of 2016 in Zimbabwe forced dairy farmers and producers to operate below normal capacity leading to low milk output. The macro-economic dilemma emanating from the liquidity crunch in Zimbabwe is also causing problems for farmers as they are failing to withdraw cash from banks to cover day to day expenses such as wages and other sundry expenses. The situation has also been acerbated by payment delays by dairy processors. Dairy farmers are failing to source feeds like soya mince directly from producers. The costs are overblown if the procurement is done through the GMB, a parastatal. The government itself is failing to provide rebates and subsidies on imports of inputs but is concentrating more on providing maize for human consumption and foregoing the livestock due to financial constraints. Input costs, particularly energy costs are too high, thereby inflating production costs. Kagoro, and

Chatiza (2012: 28) mention that the economic situation of Zimbabwe has left the government underfunded and unable to provide services to dairy farmers.

5.10 Conclusion

This chapter presented analysed and discussed the research findings in light of the literature reviewed in Chapters 2 and 3. Chapter 6 is the concluding chapter and it will summarise the conclusions of this study. It will also review each of the objectives and also discuss the recommendations for future researches.

Chapter 6

Conclusions and Recommendations

6.1 Introduction

The overriding purpose of this study was to establish the disaster risks that Zimbabwe's dairy supply chains are exposed to. From the background of the study it was evident that the disruption of Zimbabwe's dairy supply chains by disaster risks had negatively affected the economy and individual livelihoods. Milk production drastically dropped to 50 million litres against an annual demand of 120 million litres (Phiri 2014: 2-3). Based on this problem, this research sought to assess disaster risk reduction strategies in use. The study assessed collaborative strategies' impact on supply chains based on the collaborative framework propounded by Shepard (2012: 8) focusing on collaboration of dairy stakeholders.

6.2 Conclusion

In this section, the researcher provides a recap of the research objectives and themes outlined in the introductory chapter. There were five objectives for this research. The research objectives were met using a mixed methods approach that combined administering a questionnaire on dairy farmers and interviews with dairy authorities and retailers. Observations were also made for the dairy supply chain network ranging from the dairy farm to dairy processors and finally, retailers. This study concludes that dairy farmers concurred that they were vulnerable to drought and animal diseases. The political and economic situation has also overally affected the farmers. For example, unethical practices among political heavyweights as well as unfriendly government policies and legislations have taken their toll on dairy farming.

Disaster risks were found to be negatively impacting on the performance of dairy supply chain networks. Through interviews with dairy authorities, this researcher established that droughts, veld fires and extreme weather conditions affected pastures as well as milk yield. Technological and input risks also negatively affected

dairy herd sizes and consequently, milk output declined. What was noteworthy in this study was that some milk processors and NGOs assisted dairy farmers with heifers and milk processing equipment. Government departments which were supposed to offer support services could not effectively carry out their mandate due to lack of financial resources and manpower. There were a few available veterinary workers as well as limited dairy officers to do the work and in some cases they were non-existent.

Existing collaborative efforts in the dairy sector were noted to be inadequate to boost the performance of the dairy supply chain. Milk production levels remained extremely low and the country continued to import milk and other milk products to supplement local output. The interviews conducted as part of this study revealed that some partnerships with NGOs were short-term and consequently could not yield sustainable impact. This study concluded that the economic meltdown in the country was one of the factors that hampered the success of collaborative strategies in reviving milk production and capacity utilization. The issue of unresolved land disputes between newly resettled farmers and former white commercial farmers also discouraged large-scale white commercial farmers from making long-term investments in growing dairy herds. Another challenge was the lack of specialized training on disaster risk preparedness targeting the dairy industry.

6.3 Recommendations for future researchers

This research has raised many areas that can be explored in future researches. Based on issues raised by this study in this section this researcher makes some suggestions for further research.

- Whilst a variety of disaster risks have been studied in this research, individual disaster risks can be interrogated in future research, to help understand the concept of collaboration in dairy supply chains to mitigate against single risks.
- A study comparing Zimbabwe's experience against other countries such as South Africa on disaster risk reduction strategies to provide empirical evidence on whether disaster risk reduction strategies have similar or different impact on countries that are at different economic and political dimensions.

Thus, further research is necessary in the areas highlighted above. However, this researcher hopes that this thesis has provided some insights into prevalent disaster risks encountered by stakeholders in dairy supply chains and collaborative measures in place to reduce these disaster risks. After all, the thesis has delved into a virgin area that had not been researched in Zimbabwe.

6.4 Limitations of the study

Like any research, this research had its limitations and raises as many questions as it answers. This section discusses these limitations. The researcher could have conducted a census by having all the dairy farmers responding to the questionnaire. Due to resource constraints, a sample of 92 dairy farmers was selected. More so, in the time frame of this study, the researcher could not access all the dairy farmers and dairy processers through a census hence resorting to sampling.

6.5 Recommendations

This section gives recommendations for future consideration and some possible implications of the findings on policy and practice.

The study recommends that:

- As a matter of policy, the Division of Livestock Production and Development should recognize the important role played by the dwindling large scale commercial milk producers, with a view to encouraging and supporting the revival of commercial dairy production. A significant number of large commercial dairy farmers were affected by the land reform programme. Instead of the current maximum 5 year lease given to white commercial farmers, the government should seriously consider issuing out long term leases in order to protect long-term investment dairy projects.
- Government ministries should take a leading role in promoting collaborative relationships. There is very little that can be achieved in reducing disaster risks without government contribution. Government should therefore create an enabling environment for partnership. The state and NGOs should overcome their historical differences and share information. The government generally perceives NGOs as regime change agencies while on the other hand NGOs

accuse government of engaging in partisan politics. NGOs should also play a role in policy formulation in dairy industry.

- Beneficiaries to a funded dairy project should have a sense of ownership from the onset of the project to build commitment and trust for effective collaborative efforts. Farmers should take charge and ownership of all funded dairy farming projects so as to build confidence and trust for effective collaborative efforts. Dairy farming project ideas should emanate from the experienced farmers to revive the dairy industry.
- The establishment of comprehensive insurance policies for farmers is recommended. Establishing insurance policies targeting the industry will certainly transfer the risk to insurers. Very few dairy farmers have confirmed reliance on insurance, as insurance is seen as a luxury by many in the industry.
- Beneficiaries of training should get appropriate and timely training programmes in aspects of disaster risk reduction in dairy cattle production.
- There should be longer-term disaster risk reduction projects for sustainability of the dairy production.
- Strengthening inter-ministerial collaboration with relevant dairy stakeholders as a way of reducing disaster risks requires contributions from various ministries, such as Ministry of Lands and Resettlement, Ministry of Agriculture, Ministry of Education, Ministry of Health and the Ministry of Industry and Commerce.
- There should be linkages between neighbouring dairy farmers. Collaboration should not only be for dairy farmers and external stakeholders such as government departments and NGOs, but dairy farmers also need to render support to each another by sharing expertise and experiences in disaster risk reduction issues.
- There should be community based disaster risk reduction office at ward level, run by a committee involving government officials and local farmers coordinating the implementation of disaster risk reduction strategies. Farmers should embrace technology such as mobile phones in disseminating and accessing disaster early warning data.

- Local collection of disaster Early Warning Signs data is recommended to improve transmission of intended messages to stakeholders through frequent contacts.
- There should be clear linkages between the Department of Dairy Services and other government departments which provide services to the dairy farmers. Harmonization of policies, so that they several departments be merged under one Government Department is also recommended. Policies that strictly govern the conduct and activities of dairy farming should be housed in one ministry that speaks to dairy farmers.
- There is political prevarication for political gains in the Zimbabwean agrarian reform agenda. The whole process of the land reform programme should be speedily concluded so that a clearly non-political land policy that will not affect production on dairy farms is enacted. Pre-existing issues and unresolved land disputes between newly resettled farmers and former white commercial farmers must be addressed as a matter of urgency.
- Acknowledging the current heifer support schemes to beneficiaries and upcoming dairy producers, there is however need to upscale the programme with the view to meet demand of increasing number of farmers with a keen interest in dairy farming.
- Adequate funding in disaster risk reduction programmes in most prevalent risks in different dairy regions is also recommended. These high risks should get funding for collaborative strategies from government. Drought is one such disaster risk that affects most of the milking regions in the country. More funding should be directed towards construction of dams and boreholes to irrigate pastures and improve on milking parlours on hygiene issues.
- Government should have deliberate policies that target dairy farmers. Dairy farming requires soft attention. In view of the intention to reduce imports, it is important that government sets up a special fund directed at revitalizing dairy milk production. That fund could assist in the acquisition of breeding stock and other essential inputs as a matter of policy.
- New policy development should be quick to get to fruition. Policies such as the FMD new policy development supported by FAO and the Emergency Preparedness and Disaster Management Act. A new bill, Emergency

preparedness and disaster management was thus drafted in 2003 and has not yet been passed into law mainly due to the highly polarized Zimbabwean legislature.

- Retailers and milk processors should invest in production and marketing of livestock feeds for dairy farmers to build confidence to revive the industry.
- Small-scale dairy farmers should consolidate their input needs and procure in bulk to reduce production costs.

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APPENDICES

Appendix I:

Tobit estimates of impact of loan availability on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Loan availability	0.00915	-0.0465	0.0453	-0.205*	0.104
	(0.144)	(0.137)	(0.151)	(0.115)	(0.0873)
Gender	0.109	0.355	0.630***	0.340***	-0.0780
	(0.180)	(0.246)	(0.224)	(0.110)	(0.210)
Age	-0.0988	-0.111	-0.152*	0.0623	-0.0372
	(0.0835)	(0.0912)	(0.0772)	(0.0641)	(0.0692)
Level of education	-0.0909	-0.121	-0.268***	-0.0388	0.101
	(0.0923)	(0.132)	(0.0990)	(0.104)	(0.0978)
Experience	-0.128	0.0381	0.156*	-0.0840	-0.210**
	(0.112)	(0.130)	(0.0928)	(0.0945)	(0.0844)
Chipinge	-0.195	0.205	-0.223	-0.113	-0.479**
	(0.266)	(0.253)	(0.242)	(0.284)	(0.225)
Gweru	-0.220	0.138	-0.122	-0.253	-0.330
	(0.224)	(0.180)	(0.222)	(0.236)	(0.229)
Harare	-0.158	0.204	-0.389*	-0.0550	-0.239
	(0.233)	(0.214)	(0.230)	(0.248)	(0.240)
Bulawayo	0.0112	-0.0585	0.265	0.0140	-0.139
	(0.342)	(0.286)	(0.271)	(0.298)	(0.278)
Constant	5.333***	4.781***	4.625***	4.982***	4.645***
	(0.868)	(0.670)	(0.801)	(0.566)	(0.603)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.

Appendix II:

Tobit estimates of impact of local giants on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Local giants	0.253**	0.173	0.0923	0.0881	-0.0159
	(0.118)	(0.107)	(0.119)	(0.105)	(0.0906)
Gender	0.198	0.430	0.652***	0.411***	-0.108
	(0.191)	(0.269)	(0.221)	(0.117)	(0.207)
Age	-0.145*	-0.150	-0.168**	0.0335	-0.0297
	(0.0837)	(0.0923)	(0.0840)	(0.0666)	(0.0680)
Level of education	-0.142	-0.162	-0.283***	-0.0653	0.112
	(0.101)	(0.136)	(0.101)	(0.104)	(0.0989)
Experience	-0.114	0.0537	0.157	-0.0667	-0.220**
	(0.111)	(0.125)	(0.0945)	(0.100)	(0.0864)
Chipinge	-0.357	0.104	-0.291	-0.0986	-0.506**
	(0.280)	(0.271)	(0.264)	(0.271)	(0.230)
Gweru	0.139	0.402*	-0.00383	-0.0392	-0.403
	(0.320)	(0.241)	(0.319)	(0.325)	(0.270)
Harare	0.329	0.540*	-0.214	0.155	-0.292
	(0.370)	(0.278)	(0.346)	(0.371)	(0.311)
Bulawayo	0.341	0.154	0.388	0.109	-0.151
	(0.370)	(0.284)	(0.334)	(0.348)	(0.310)
Constant	4.668***	4.121***	4.577***	3.837***	5.162***
	(0.706)	(0.590)	(0.602)	(0.578)	(0.577)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix III:

Tobit estimates of impact of international competition on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
International competition	0.489**	0.347	-0.183	0.109	0.167
	(0.208)	(0.224)	(0.126)	(0.190)	(0.152)
Gender	0.193	0.418	0.590***	0.397***	-0.0787
	(0.185)	(0.253)	(0.222)	(0.112)	(0.206)
Age	-0.123	-0.132	-0.138*	0.0456	-0.0419
	(0.0801)	(0.0837)	(0.0767)	(0.0635)	(0.0683)
Level of education	-0.0942	-0.119	-0.265***	-0.0487	0.108
	(0.0995)	(0.129)	(0.0990)	(0.105)	(0.0953)
Experience	-0.151	0.0234	0.162*	-0.0754	-0.228***
	(0.0999)	(0.116)	(0.0897)	(0.101)	(0.0836)
Chipinge	-0.0680	0.307	-0.285	-0.0166	-0.474**
	(0.271)	(0.259)	(0.250)	(0.276)	(0.227)
Gweru	-0.0665	0.269	-0.200	-0.132	-0.330
	(0.236)	(0.196)	(0.225)	(0.233)	(0.227)
Harare	0.0602	0.359	-0.474**	0.0282	-0.193
	(0.258)	(0.230)	(0.234)	(0.246)	(0.248)
Bulawayo	0.0436	-0.0356	0.261	-0.00413	-0.128
	(0.295)	(0.246)	(0.269)	(0.279)	(0.270)
Constant	3.293***	3.096***	5.592***	3.614***	4.422***
	(0.930)	(1.055)	(0.737)	(0.924)	(0.718)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix IV:

Tobit estimates of impact of government policy on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Government policy	0.129	0.195	-0.0617	0.110	-0.0118
	(0.115)	(0.132)	(0.104)	(0.106)	(0.0908)
Gender	0.135	0.410	0.608***	0.406***	-0.106
	(0.180)	(0.256)	(0.222)	(0.114)	(0.209)
Age	-0.110	-0.135	-0.143*	0.0392	-0.0166
	(0.0837)	(0.0890)	(0.0775)	(0.0639)	(0.0667)
Level of education	-0.114	-0.156	-0.258**	-0.0631	0.0693
	(0.112)	(0.146)	(0.111)	(0.115)	(0.0964)
Experience	-0.125	0.0486	0.151	-0.0686	-0.213**
	(0.111)	(0.129)	(0.0946)	(0.0982)	(0.0815)
Chipinge	-0.174	0.260	-0.252	-0.0215	-0.507**
	(0.261)	(0.260)	(0.249)	(0.277)	(0.235)
Gweru	-0.183	0.227	-0.165	-0.127	-0.392*
	(0.221)	(0.190)	(0.228)	(0.239)	(0.233)
Harare	-0.0891	0.330	-0.438*	0.0510	-0.304
	(0.242)	(0.251)	(0.243)	(0.259)	(0.250)
Bulawayo	0.0214	-0.0396	0.263	0.00380	-0.143
	(0.334)	(0.273)	(0.268)	(0.286)	(0.280)
Constant	4.881***	3.823***	5.070***	3.649***	5.159***
	(0.665)	(0.722)	(0.656)	(0.621)	(0.584)
Observations	77	77	77	77	77

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix V:

Tobit estimates of impact of political interference on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion of herd	(4) Hindered growth	(5) Productivity
Political interference	0.492**	0.233	-0.221*	0.134	0.272**
	(0.230)	(0.255)	(0.123)	(0.182)	(0.136)
Gender	0.159	0.388	0.596***	0.396***	-0.0762
	(0.174)	(0.246)	(0.223)	(0.110)	(0.186)
Age	-0.131	-0.129	-0.135*	0.0422	-0.0523
	(0.0836)	(0.0892)	(0.0732)	(0.0618)	(0.0679)
Level of education	-0.192**	-0.173	-0.217**	-0.0762	0.0496
	(0.0957)	(0.144)	(0.105)	(0.107)	(0.0986)
Experience	-0.0867	0.0629	0.140	-0.0595	-0.196***
	(0.0842)	(0.110)	(0.0943)	(0.0952)	(0.0722)
Chipinge	-0.248	0.199	-0.223	-0.0556	-0.537**
	(0.247)	(0.260)	(0.246)	(0.271)	(0.226)
Gweru	-0.134	0.203	-0.181	-0.140	-0.326
	(0.211)	(0.199)	(0.227)	(0.237)	(0.230)
Harare	-0.0990	0.243	-0.429*	0.00131	-0.226
	(0.217)	(0.234)	(0.237)	(0.248)	(0.240)
Bulawayo	0.0532	-0.0482	0.271	0.000820	-0.118
	(0.257)	(0.252)	(0.266)	(0.277)	(0.264)
Constant	3.554***	3.710***	5.623***	3.579***	4.126***
	(0.980)	(1.096)	(0.719)	(0.880)	(0.696)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix VI:

Tobit estimates of impact of government policy on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Drought	0.119	-0.114	0.0492	0.320***	0.0614
	(0.152)	(0.121)	(0.133)	(0.119)	(0.149)
Gender	0.0819	0.390	0.609***	0.310***	-0.117
	(0.186)	(0.258)	(0.215)	(0.113)	(0.220)
Age	-0.105	-0.107	-0.152*	0.0307	-0.0367
	(0.0842)	(0.0866)	(0.0763)	(0.0628)	(0.0700)
Level of education	-0.0754	-0.139	-0.259***	-0.0139	0.117
	(0.0882)	(0.127)	(0.0968)	(0.104)	(0.0971)
Experience	-0.121	0.0375	0.154	-0.0521	-0.216**
	(0.109)	(0.128)	(0.0952)	(0.0961)	(0.0869)
Chipinge	-0.112	0.135	-0.205	0.158	-0.472*
	(0.280)	(0.286)	(0.251)	(0.261)	(0.237)
Gweru	-0.390	0.316	-0.213	-0.639**	-0.466
	(0.327)	(0.231)	(0.316)	(0.277)	(0.336)
Harare	-0.361	0.405	-0.484	-0.586*	-0.364
	(0.365)	(0.304)	(0.372)	(0.311)	(0.348)
Bulawayo	-0.224	0.162	0.166	-0.660*	-0.249
	(0.513)	(0.390)	(0.412)	(0.351)	(0.431)
Constant	5.059***	4.870***	4.703***	3.281***	4.958***
	(0.710)	(0.572)	(0.592)	(0.542)	(0.574)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix VII:

Tobit estimates of impact of cattle disease on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cattle disease	0.138	0.422	-0.115	0.264	0.0349
	(0.237)	(0.259)	(0.167)	(0.176)	(0.175)
Gender	0.107	0.363	0.619***	0.384***	-0.104
	(0.180)	(0.237)	(0.220)	(0.115)	(0.211)
Age	-0.103	-0.129	-0.146*	0.0402	-0.0339
	(0.0837)	(0.0910)	(0.0748)	(0.0629)	(0.0672)
Level of education	-0.0792	-0.0933	-0.273***	-0.0285	0.112
	(0.0900)	(0.121)	(0.101)	(0.105)	(0.0980)
Experience	-0.142	0.00846	0.163*	-0.0945	-0.223**
	(0.122)	(0.120)	(0.0946)	(0.0956)	(0.0894)
Chipinge	-0.209	0.189	-0.229	-0.0743	-0.520**
	(0.259)	(0.231)	(0.247)	(0.283)	(0.233)
Gweru	-0.221	0.167	-0.143	-0.161	-0.381
	(0.226)	(0.174)	(0.230)	(0.235)	(0.232)
Harare	-0.172	0.169	-0.388	-0.0421	-0.265
	(0.238)	(0.223)	(0.238)	(0.247)	(0.249)
Bulawayo	-0.0502	-0.252	0.323	-0.117	-0.145
	(0.382)	(0.334)	(0.273)	(0.277)	(0.291)
Constant	4.841***	2.938**	5.272***	3.060***	4.985***
	(1.000)	(1.155)	(0.904)	(0.826)	(0.819)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix VIII:

Tobit estimates of impact of cyclones on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cyclones	0.218	0.251	-0.287	-0.157	0.0924
	(0.222)	(0.210)	(0.182)	(0.179)	(0.164)
Gender	0.118	0.382	0.603***	0.372***	-0.0987
	(0.177)	(0.251)	(0.213)	(0.106)	(0.208)
Age	-0.105	-0.122	-0.138*	0.0565	-0.0360
	(0.0800)	(0.0855)	(0.0778)	(0.0633)	(0.0677)
Level of education	-0.101	-0.141	-0.250**	-0.0426	0.104
	(0.0918)	(0.136)	(0.106)	(0.103)	(0.0962)
Experience	-0.113	0.0651	0.129	-0.0828	-0.213**
	(0.101)	(0.120)	(0.0964)	(0.0994)	(0.0825)
Chipinge	-0.332	0.0675	-0.0861	0.0425	-0.576**
	(0.260)	(0.267)	(0.244)	(0.275)	(0.241)
Gweru	0.101	0.527	-0.592*	-0.411	-0.245
	(0.445)	(0.337)	(0.340)	(0.373)	(0.358)
Harare	0.229	0.652*	-0.928**	-0.308	-0.0987
	(0.526)	(0.386)	(0.383)	(0.437)	(0.430)
Bulawayo	0.381	0.361	-0.243	-0.287	0.0244
	(0.475)	(0.360)	(0.411)	(0.411)	(0.396)
Constant	4.590***	3.676***	5.868***	4.650***	4.792***
	(0.978)	(0.753)	(0.822)	(0.791)	(0.744)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix IX:

Tobit estimates of impact of extreme cold weather on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cold extreme weather	0.00822	0.0951	0.227**	0.159	-0.0386
	(0.107)	(0.0902)	(0.0959)	(0.103)	(0.113)
Gender	0.104	0.334	0.555**	0.330***	-0.0918
	(0.184)	(0.256)	(0.221)	(0.120)	(0.205)
Age	-0.0987	-0.117	-0.159**	0.0481	-0.0322
	(0.0842)	(0.0865)	(0.0739)	(0.0646)	(0.0678)
Level of education	-0.0911	-0.134	-0.293***	-0.0649	0.111
	(0.0933)	(0.131)	(0.0903)	(0.102)	(0.0991)
Experience	-0.127	0.0555	0.185**	-0.0536	-0.224**
	(0.112)	(0.124)	(0.0819)	(0.0975)	(0.0865)
Chipinge	-0.188	0.335	0.00748	0.130	-0.565**
	(0.278)	(0.253)	(0.214)	(0.252)	(0.266)
Gweru	-0.232	0.0682	-0.387	-0.335	-0.345
	(0.258)	(0.219)	(0.240)	(0.253)	(0.267)
Harare	-0.166	0.138	-0.603**	-0.158	-0.232
	(0.258)	(0.242)	(0.254)	(0.256)	(0.276)
Bulawayo	0.00725	-0.114	0.117	-0.122	-0.111
	(0.360)	(0.299)	(0.256)	(0.305)	(0.294)
Constant	5.351***	4.299***	4.214***	3.639***	5.235***
	(0.634)	(0.455)	(0.464)	(0.469)	(0.597)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix X:

Tobit estimates of impact of feeds processing technology on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Feeds processing	0.0267	0.0793	0.0681	0.0923	0.0696
	(0.185)	(0.103)	(0.106)	(0.0939)	(0.107)
Gender	0.105	0.362	0.619***	0.378***	-0.110
	(0.180)	(0.247)	(0.215)	(0.111)	(0.209)
Age	-0.0983	-0.113	-0.148*	0.0535	-0.0305
	(0.0832)	(0.0876)	(0.0771)	(0.0650)	(0.0696)
Level of education	-0.0881	-0.118	-0.260**	-0.0415	0.116
	(0.0929)	(0.130)	(0.0983)	(0.106)	(0.102)
Experience	-0.130	0.0401	0.150	-0.0746	-0.224**
	(0.113)	(0.126)	(0.0952)	(0.101)	(0.0877)
Chipinge	-0.196	0.233	-0.228	-0.0361	-0.509**
	(0.264)	(0.258)	(0.249)	(0.278)	(0.232)
Gweru	-0.220	0.176	-0.127	-0.149	-0.368
	(0.225)	(0.189)	(0.231)	(0.235)	(0.233)
Harare	-0.156	0.227	-0.386	-0.00241	-0.253
	(0.233)	(0.224)	(0.238)	(0.243)	(0.245)
Bulawayo	0.0138	-0.0483	0.278	0.00429	-0.122
	(0.339)	(0.284)	(0.272)	(0.285)	(0.279)
Constant	5.259***	4.219***	4.525***	3.664***	4.810***
	(0.960)	(0.770)	(0.744)	(0.686)	(0.756)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XI:

Tobit estimates of impact of milk and packaging technology on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Milk and packaging technology	0.153	0.327	-0.0443	0.164	0.396**
	(0.282)	(0.242)	(0.171)	(0.200)	(0.157)
Gender	0.114	0.376	0.617***	0.391***	-0.0739
	(0.177)	(0.238)	(0.218)	(0.109)	(0.208)
Age	-0.103	-0.125	-0.148*	0.0446	-0.0444
	(0.0834)	(0.0875)	(0.0755)	(0.0641)	(0.0687)
Level of education	-0.0956	-0.134	-0.263**	-0.0555	0.0936
	(0.0919)	(0.126)	(0.100)	(0.105)	(0.0941)
Experience	-0.111	0.0781	0.148	-0.0513	-0.175**
	(0.101)	(0.113)	(0.0947)	(0.0993)	(0.0798)
Chipinge	-0.221	0.174	-0.230	-0.0761	-0.569**
	(0.257)	(0.253)	(0.250)	(0.278)	(0.223)
Gweru	-0.235	0.138	-0.137	-0.182	-0.404*
	(0.222)	(0.189)	(0.231)	(0.230)	(0.213)
Harare	0.182	0.950	-0.497	0.347	0.638
	(0.642)	(0.589)	(0.452)	(0.477)	(0.444)
Bulawayo	-0.0236	-0.130	0.280	-0.0416	-0.208
	(0.362)	(0.299)	(0.280)	(0.276)	(0.256)
Constant	4.732***	3.211***	5.009***	3.397***	3.443***
	(1.201)	(1.026)	(0.899)	(0.913)	(0.776)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XII:

Tobit estimates of impact of power outages on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Power outages	0.0508	0.199	0.419**	0.386*	0.500***
	(0.232)	(0.241)	(0.208)	(0.210)	(0.183)
Gender	0.0979	0.333	0.551***	0.321***	-0.193
	(0.184)	(0.238)	(0.196)	(0.107)	(0.191)
Age	-0.0967	-0.106	-0.131*	0.0629	-0.0127
	(0.0836)	(0.0902)	(0.0704)	(0.0607)	(0.0649)
Level of education	-0.0861	-0.109	-0.233**	-0.0228	0.151
	(0.0910)	(0.127)	(0.0939)	(0.101)	(0.0921)
Experience	-0.126	0.0540	0.174*	-0.0424	-0.194**
	(0.109)	(0.121)	(0.0970)	(0.0958)	(0.0808)
Chipinge	-0.192	0.246	-0.187	-0.00386	-0.450*
	(0.264)	(0.261)	(0.233)	(0.259)	(0.227)
Gweru	-0.219	0.181	-0.0984	-0.126	-0.322
	(0.223)	(0.190)	(0.227)	(0.227)	(0.229)
Harare	-0.160	0.213	-0.399*	-0.0241	-0.254
	(0.234)	(0.223)	(0.234)	(0.238)	(0.241)
Bulawayo	-0.00347	-0.118	0.147	-0.114	-0.246
	(0.371)	(0.325)	(0.269)	(0.286)	(0.277)
Constant	5.143***	3.657***	2.904***	2.316**	2.820***
	(1.116)	(1.269)	(0.999)	(0.990)	(0.848)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XIII:

Tobit estimates of impact of high labour costs on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	**Job loss**	**Food security**	**Depletion herd**	**Hindered growth**	**Productivity**
High labor cost	0.0867	0.177	0.0137	0.241*	0.0120
	(0.167)	(0.139)	(0.138)	(0.124)	(0.175)
Gender	0.122	0.398	0.623***	0.427***	-0.102
	(0.183)	(0.253)	(0.221)	(0.125)	(0.213)
Age	-0.104	-0.125	-0.150*	0.0351	-0.0334
	(0.0835)	(0.0881)	(0.0769)	(0.0640)	(0.0681)
Level of education	-0.0925	-0.130	-0.266***	-0.0572	0.109
	(0.0925)	(0.127)	(0.0993)	(0.106)	(0.0990)
Experience	-0.122	0.0554	0.153	-0.0532	-0.219**
	(0.111)	(0.124)	(0.0961)	(0.101)	(0.0873)
Chipinge	-0.204	0.210	-0.238	-0.0585	-0.517**
	(0.264)	(0.260)	(0.248)	(0.277)	(0.233)
Gweru	-0.226	0.157	-0.141	-0.168	-0.382
	(0.224)	(0.185)	(0.229)	(0.232)	(0.232)
Harare	-0.143	0.252	-0.394	0.0349	-0.260
	(0.234)	(0.227)	(0.242)	(0.244)	(0.246)
Bulawayo	-0.0141	-0.108	0.265	-0.0644	-0.133
	(0.347)	(0.293)	(0.275)	(0.276)	(0.284)
Constant	5.196***	4.211***	4.799***	3.583***	5.095***
	(0.708)	(0.623)	(0.586)	(0.525)	(0.626)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XIV:

Tobit estimates of impact of cost of breeding herd on job losses, food security, depletion of dairy herd, hindrance to growth and milk productivity.

VARIABLES	(1) Job loss	(2) Food security	(3) Depletion herd	(4) Hindered growth	(5) Productivity
Cost breeding herd	0.745**	0.483*	-0.0939	0.124	0.139
	(0.318)	(0.285)	(0.234)	(0.220)	(0.226)
Gender	0.111	0.362	0.619***	0.380***	-0.108
	(0.186)	(0.236)	(0.218)	(0.110)	(0.208)
Age	-0.0695	-0.0924	-0.153*	0.0571	-0.0257
	(0.0824)	(0.0870)	(0.0787)	(0.0664)	(0.0706)
Level of education	-0.114	-0.137	-0.261**	-0.0528	0.105
	(0.0937)	(0.131)	(0.101)	(0.107)	(0.0986)
Experience	-0.0986	0.0596	0.148	-0.0672	-0.215**
	(0.111)	(0.121)	(0.0953)	(0.0999)	(0.0849)
Chipinge	-0.0432	0.339	-0.257	-0.0200	-0.487**
	(0.229)	(0.288)	(0.249)	(0.283)	(0.231)
Gweru	-0.0686	0.275	-0.163	-0.138	-0.350
	(0.216)	(0.231)	(0.231)	(0.240)	(0.229)
Harare	0.0519	0.366	-0.426*	0.0202	-0.220
	(0.218)	(0.267)	(0.246)	(0.255)	(0.250)
Bulawayo	-0.0638	-0.0998	0.278	-0.0217	-0.147
	(0.318)	(0.284)	(0.275)	(0.283)	(0.279)
Constant	2.010	2.366	5.251***	3.515***	4.487***
	(1.443)	(1.450)	(1.230)	(1.110)	(1.123)
Observations	78	78	78	78	78

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XV:

Tobit estimates for the impact of data sharing on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Sharing data	-0.0769	-0.0184	0.131	0.0391
	(0.156)	(0.130)	(0.158)	(0.128)
Gender	-0.0619	-0.302	0.138	0.335
	(0.390)	(0.232)	(0.226)	(0.261)
Age	0.00522	-0.179*	-0.162*	-0.127
	(0.124)	(0.0984)	(0.0962)	(0.0941)
Level of education	-0.155	-0.0393	-0.0378	-0.114
	(0.162)	(0.0939)	(0.126)	(0.111)
Experience	0.0479	0.0825	-0.182	-0.182*
	(0.153)	(0.0959)	(0.113)	(0.106)
Chipinge	0.393	-0.0383	0.0492	0.406
	(0.467)	(0.279)	(0.385)	(0.399)
Gweru	-0.247	0.0119	0.273	0.128
	(0.450)	(0.248)	(0.350)	(0.381)
Harare	0.0130	0.317	0.116	0.126
	(0.465)	(0.258)	(0.336)	(0.359)
Bulawayo	-0.129	0.0748	-0.420	0.220
	(0.513)	(0.249)	(0.338)	(0.388)
Constant	2.902***	3.329***	3.531***	3.160***
	(0.886)	(0.739)	(0.813)	(0.725)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XVI:

Tobit estimate for the impact of collaboration with Agriculture Ministry on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Agriculture	-0.737**	0.407*	0.118	0.107
	(0.298)	(0.236)	(0.300)	(0.272)
Gender	-0.138	-0.233	0.0997	0.334
	(0.388)	(0.237)	(0.227)	(0.247)
Age	-0.0305	-0.167*	-0.142	-0.119
	(0.114)	(0.0951)	(0.0951)	(0.0930)
Level of education	-0.189	-0.0296	-0.0144	-0.104
	(0.167)	(0.0973)	(0.124)	(0.110)
Experience	0.0879	0.0583	-0.189*	-0.188*
	(0.147)	(0.0948)	(0.110)	(0.111)
Chipinge	0.446	-0.0550	0.0115	0.394
	(0.451)	(0.274)	(0.381)	(0.393)
Gweru	-0.203	-0.000314	0.238	0.117
	(0.418)	(0.232)	(0.343)	(0.376)
Harare	0.178	0.226	0.0827	0.102
	(0.442)	(0.242)	(0.325)	(0.348)
Bulawayo	0.00693	0.0705	-0.586*	0.168
	(0.440)	(0.240)	(0.327)	(0.367)
Constant	5.759***	1.539	3.499**	2.845**
	(1.504)	(1.184)	(1.403)	(1.419)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XVII:

Tobit estimate for the impact of collaboration with Education Ministry on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Education	-0.00120	-0.0689	0.0977	0.218
	(0.168)	(0.122)	(0.159)	(0.178)
Gender	-0.0283	-0.291	0.0781	0.310
	(0.388)	(0.240)	(0.229)	(0.249)
Age	-0.00431	-0.188*	-0.136	-0.101
	(0.125)	(0.0974)	(0.0947)	(0.0907)
Level of education	-0.166	-0.0508	-0.00549	-0.0796
	(0.167)	(0.0936)	(0.121)	(0.107)
Experience	0.0476	0.0979	-0.204	-0.231**
	(0.158)	(0.102)	(0.124)	(0.113)
Chipinge	0.412	-0.0430	0.0307	0.426
	(0.466)	(0.280)	(0.380)	(0.388)
Gweru	-0.228	0.0258	0.229	0.0881
	(0.450)	(0.246)	(0.351)	(0.384)
Harare	0.0164	0.313	0.116	0.139
	(0.464)	(0.259)	(0.335)	(0.354)
Bulawayo	-0.0356	0.110	-0.596*	0.133
	(0.475)	(0.253)	(0.336)	(0.370)
Constant	2.627***	3.414***	3.786***	2.821***
	(0.809)	(0.677)	(0.640)	(0.709)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XVIII:

Tobit estimate for the impact of Environment ministry on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Environment	-0.526**	-0.221	0.0924	0.433*
	(0.260)	(0.167)	(0.234)	(0.241)
Gender	-0.0176	-0.291	0.0810	0.312
	(0.368)	(0.242)	(0.228)	(0.242)
Age	-0.0189	-0.188*	-0.144	-0.110
	(0.124)	(0.0949)	(0.0976)	(0.0924)
Level of education	-0.155	-0.0375	-0.0198	-0.116
	(0.162)	(0.0942)	(0.122)	(0.101)
Experience	0.0175	0.0697	-0.177	-0.158
	(0.149)	(0.0960)	(0.110)	(0.105)
Chipinge	0.524	0.0141	-0.00249	0.309
	(0.448)	(0.317)	(0.381)	(0.379)
Gweru	-0.140	0.0537	0.227	0.0507
	(0.428)	(0.274)	(0.345)	(0.368)
Harare	0.0892	0.351	0.0955	0.0647
	(0.434)	(0.282)	(0.332)	(0.324)
Bulawayo	0.0440	0.131	-0.592*	0.111
	(0.445)	(0.280)	(0.330)	(0.351)
Constant	4.852***	4.199***	3.610***	1.462
	(1.190)	(0.790)	(1.216)	(1.340)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XIX:

Tobit estimates for the impact of collaborative association on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Cooperatives	-0.109	0.321*	0.197	0.149
	(0.149)	(0.187)	(0.280)	(0.189)
Gender	-0.0422	-0.257	0.107	0.337
	(0.391)	(0.243)	(0.219)	(0.249)
Age	-0.0129	-0.156*	-0.130	-0.111
	(0.125)	(0.0901)	(0.0997)	(0.0917)
Level of education	-0.158	-0.0647	-0.0329	-0.119
	(0.166)	(0.0943)	(0.123)	(0.106)
Experience	0.0421	0.0994	-0.173	-0.175
	(0.150)	(0.0977)	(0.117)	(0.108)
Chipinge	0.408	-0.0210	0.0256	0.403
	(0.467)	(0.272)	(0.380)	(0.395)
Gweru	-0.226	0.00946	0.239	0.116
	(0.445)	(0.234)	(0.343)	(0.381)
Harare	-0.00248	0.373	0.143	0.150
	(0.464)	(0.243)	(0.334)	(0.357)
Bulawayo	-0.0481	0.128	-0.556*	0.189
	(0.465)	(0.237)	(0.331)	(0.372)
Constant	3.125***	1.787*	3.100**	2.616**
	(0.982)	(1.038)	(1.499)	(1.023)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XX:

Tobit estimate of the impact of collaborative strategies on supply chain costs, lead time, milk sales and milk variety and quality

VARIABLES	(1) Supply chain costs	(2) Lead time	(3) Sales	(4) Variety and quality
Collaborative strategies	-0.175**	0.0418	0.118	0.147**
	(0.0696)	(0.0871)	(0.0938)	(0.0614)
Gender	-0.143	-0.268	0.158	0.414
	(0.378)	(0.238)	(0.211)	(0.263)
Age	-0.0255	-0.176*	-0.132	-0.104
	(0.120)	(0.0964)	(0.0924)	(0.0894)
Level of education	-0.151	-0.0454	-0.0282	-0.120
	(0.164)	(0.0929)	(0.121)	(0.107)
Experience	0.0792	0.0750	-0.204*	-0.209**
	(0.149)	(0.0955)	(0.110)	(0.104)
Chipinge	0.382	-0.0271	0.0358	0.422
	(0.456)	(0.275)	(0.371)	(0.377)
Gweru	-0.207	0.0110	0.227	0.101
	(0.432)	(0.240)	(0.338)	(0.370)
Harare	0.0291	0.315	0.0999	0.115
	(0.447)	(0.250)	(0.323)	(0.339)
Bulawayo	-0.199	0.135	-0.468	0.311
	(0.452)	(0.229)	(0.322)	(0.364)
Constant	5.934***	2.474	1.782	0.525
	(1.575)	(1.676)	(1.936)	(1.420)
Observations	79	79	79	79

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix XXI:

Questionnaire for dairy farmers

THE ASSESSMENT OF DISASTER REDUCTION STRATEGIES IN DAIRY SUPPLY CHAINS IN ZIMBABWE

QUESTIONNAIRE

This researcher would greatly appreciate your assistance in completing this questionnaire as part of a survey on the impact of disaster reduction strategies in dairy supply chains in Zimbabwe. The results of this study will assist the Zimbabwe dairy sector in establishing the possible strategies that can be engaged in to improve supply chain performance.

The questionnaire is **ANONYMOUS** and all responses will remain **STRICTLY CONFIDENTIAL** and will be used for academic purposes only.

I thank you in advance for your time and effort in filling out this questionnaire.

Should you require additional information concerning this study or further clarity, you may contact the researcher as per the following details:

_____

Felix Chari
charifelix93@gmail.com
+263 77 599 4001

ANNEXURE

Questionnaire

Section A: Demographic Data

1. Gender

Male	01
Female	02

2. How old are you?

18-24	01
25-30	02
31-40	03
41-50	04
51-60	05
60+	06

3. Level of Education

O Level	01
Diploma	02
Degree	03
Post Graduate	04

4. Region Located

Chipinge	01
Gweru	02
Harare	03
Bulawayo	04
Mutare	05
Other	06

6. Experience in dairy farming

0-5 years	01
6-10 years	02
11-15 years	03
16 and above	04

7. Position

Farm owner	01
Employee	02

INSTRUCTIONS: INSTRUCTIONS: Below is a list of risks affecting dairy industry. Please rate how strongly you agree or disagree that the following risk affects you by placing a check mark in the appropriate box.

1- Strongly disagree

2- Disagree

3- Uncertain

4- Agree

5- Strongly agree

SECTION B: Supply chain risks affecting dairy industry	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
8. Financial Risk	1	2	3	4	5
9. Inadequate loan facilities for dairy industry	1	2	3	4	5
10. High interest rates	1	2	3	4	5
11.Poor infrastructure	1	2	3	4	5
12. Shortage of breeding herd	1	2	3	4	5
COMPETITION					
13.Local dairy giants flexing	1	2	3	4	5

financial muscle					
14. Unfair competition from foreign dairy brands	1	2	3	4	5
SOCIO-POLITICAL					
15.Government policy inconsistency in agricultural sector	1	2	3	4	5
16. Unethical practices in government administration	1	2	3	4	5
ENVIRONMENTAL					
Which of the following natural hazards are predominant in your locality?	1	2	3	4	5
17.Droughts	1	2	3	4	5
18. Veld fires	1	2	3	4	5
19. Lightning	1	2	3	4	5
20. Pests which consume pastures	1	2	3	4	5
21. Human Diseases	1	2	3	4	5
22.Cattle diseases	1	2	3	4	5
23. Cyclones	1	2	3	4	5
24.Floods,	1	2	3	4	5
25. Extreme hot weather conditions	1	2	3	4	5
26. Extreme cold weather conditions	1	2	3	4	5
27. Incessant rains	1	2	3	4	5
TECHNOLOGY					
Technological challenges inhibiting growth of dairy in Zimbabwe					
28.Feeds	1	2	3	4	5

29.Processing facilities	1	2	3	4	5
30.Milking and packaging equipment	1	2	3	4	5
31. Disaster early warning technology	1	2	3	4	5
32. Record keeping technology	1	2	3	4	5
Man-made risks					
33.Long lead times for both inputs and produce	1	2	3	4	5
34. Road accidents	1	2	3	4	5
35.Poor road network infrastructure	1	2	3	4	5
36.Perishability of milk	1	2	3	4	5
37. Man-made veld fires	1	2	3	4	5
PRODUCTION					
Which input risks do you experience in dairy production?					
38.High input costs	1	2	3	4	5
39.Scarcity of feeds	1	2	3	4	5
40.Power outages	1	2	3	4	5
41.Obsolete machinery	1	2	3	4	5
42.High labour costs	1	2	3	4	5
43. Legislation and obscure government policies	1	2	3	4	5
44. High cost of breeding herd	1	2	3	4	5

Indicate how the following disaster risks have impacted on the dairy supply chain performance.

SECTION C: Impact of disaster risks on dairy supply chain performance	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
45. Natural disasters have killed the livelihoods of the farming community through job losses	1	2	3	4	5
46. Disasters plaguing the dairy industry are threatening food security	1	2	3	4	5
47. Depletion of dairy herd making it hard for farmers to adequately supply milk to feed Zimbabwe and export milk	1	2	3	4	5
48. Disasters in the dairy industry are exposing local dairy companies to fierce competition thereby hindering growth of infant industries	1	2	3	4	5
49.The quality of milk has deteriorated owing to the low quality of pastures and stock feeds	1	2	3	4	5
50. The decline in milk output has led to the closure of some processing plants	1	2	3	4	5
51. The low milk output has led in a decline in foreign currency earnings.	1	2	3	4	5

INSTRUCTIONS: Please rate how strongly you agree or disagree with each of the following statements by placing a check mark in the appropriate box.

1- Strongly disagree

2- Disagree

3- Uncertain

4- Agree

5- Strongly agree

SECTION D: Collaborative strategies	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
Which of the following collaborative strategies do you employ as a supply chain partner in dairy industry?					
52. Public funded insurance targeting dairy industry	1	2	3	4	5
53. Joint collection of information on disaster risks	1	2	3	4	5
54. Share information and experiences by forming relevant databases	1	2	3	4	5
55. Dialogue between government and dairy industry on disaster mitigation	1	2	3	4	5
56. Liaison between researchers, government and dairy industry practitioners on disaster reduction	1	2	3	4	5

There has been collaboration in dairy disaster risk reduction with the following:	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
57. Agriculture	1	2	3	4	5
58. Health	1	2	3	4	5
59. Education	1	2	3	4	5
60. Water resources	1	2	3	4	5
61. Environment	1	2	3	4	5
62. Special low interest loan facility for dairy farmers.	1	2	3	4	5
63. Training workshops for farmers	1	2	3	4	5
64. Dairy farmer cooperatives	1	2	3	4	5
65. Supply chain member integration (backward/forward)	1	2	3	4	5

SECTION E: Impact of collaborative strategies on dairy supply chains	**Strongly Disagree**	**Disagree**	**Uncertain**	**Agree**	**Strongly agree**
The above collaborative strategies have helped reduce the following in dairy supply chains:					
67. Total supply chain cost	1	2	3	4	5
68. Lead time	1	2	3	4	5
The above collaborative strategies have helped increase the following in dairy supply chains:					
69. Milk production	1	2	3	4	5
70. Milk and milk product sales	1	2	3	4	5
71. Dairy product variety and quality	1	2	3	4	5
72. Flexibility [in terms of time, milk volume, variety so as to ensure customer satisfaction].	1	2	3	4	5

Section F Challenges for collaboration

What are the challenges that affect collaboration with dairy supply chain partners?	Strongly Disagree	Disagree	Uncertain	Agree	Strongly agree
73. Economic situation	1	2	3	4	5
74. Stakeholders skeptical about each other	1	2	3	4	5
75. Lack of training on disaster preparedness	1	2	3	4	5
76. Lack of adequate time for collaboration	1	2	3	4	5
77. Do you think our government has created a conducive environment for NGOs to partake in disaster reduction management?	1	2	3	4	5

THANK YOU!

Appendix XXII:

Interview schedule for dairy farming authorities

INTERVIEW SCHEDULE FOR DAIRY FARMING AUTHORITIES

Place of interview

Date of interview:

Introduction

- ✓ Researcher introduces self
- ✓ State estimated Time line (duration of interview)
- ✓ Motivation for conducting interview

QUESTIONS

SECTION A: DEMOGRAPHICS

1. Which organisation do you work for?

2. How long have you been with the organisation?

3. What position do you hold in the organisation?

SECTION B: IMPACT OF DISASTER RISKS ON DAIRY SUPPLY CHAIN PERFORMANCE

4. How is the social a political framework of the country impacting on performance of the dairy industry?

5. How has the economic situation of the country affected the performance of the dairy industry?

6. Has the dairy industry in the region experienced any natural disaster?

7. To what extend have natural disaster impacted on the performance of the dairy industry?

8. **SECTION C: MITIGATION STRATEGIES FOR NATURAL HAZARDS**

8. Do you have any contingency plan in case of disasters? If so specify. How effective were these plans?

9. Which organisations are responsible for disaster reduction your region? Are they effective in implementing their plans?

SECTION D: COLLABORATIVE STRATEGIES TO AVERT DISASTERS

10. In your opinion what has the government done in terms of disaster reduction in dairy industry?

11. Are you aware of national disaster reduction policies and relevant acts? What are the issues raised?

12. In your opinion are the national disaster reduction policies and provisions in the legislature adequate?

13. To what extend are the policies and legislature influencing dairy farmers operations?

14. Has disaster risk reduction training been undertaken in the dairy industry?

15. Who have been the participants of the training?

16. What efforts have lobbyists made to protect the dairy supply chain from disaster risks plaguing the local dairy industry?

17. Does dairy farming have any financial assistance from any financial institutions/NGO?

18. If yes what are the conditions access the funds.

END Thank you for your time

Appendix XXIII:

Interview schedule for dairy products retailers

INTERVIEW SCHEDULE FOR DAIRY PRODUCTS RETAILERS

Place of interview _____

Date of interview _____

Introduction

- Researcher introduces self
- State estimated Time line (duration of interview)
- Motivation for conducting interview

Demographics

1. Which organisation do you work for?
2. How long have you been with the organisation?
3. What position do you hold in the organisation?

IMPACT OF DAIRY DISASTERS ON SUPPLY CHAIN PERFORMANCE

5. Which dairy products occupy more shelf space between local and imported imports? What might be the reason?
6. What are challenges that you encounter when importing milk products?
7. What are the challenges that you encounter when procuring local milk products?
8. Identify supply chain participants for local milk products?
9. Identify supply chain participants for imported milk products?

COLLABORATIVE/ MITIGATION STRATEGIES FOR DISASTER RISK

10. Is there any arrangement between retailers and local dairy processors thatensure continuity of supply?
11. What efforts has the government made to protect local dairy brands from foreign competition?
12. What could be the best way to overcome risks plaguing the local dairy industry particularly the retail market?

Appendix XXIV:

ACCESS LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH

The Director

Division of Livestock Production and Development

18 Borrowdale Road

Harare

24 May 2016

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Doctor of Technology student in the Department of Public Management at Durban University of Technology. The proposed topic of my research is: *The assessment of disaster risk reduction strategies in dairy supply chains in Zimbabwe.* The objectives of the study are:

- To explore the disaster risks that plague the Zimbabwe dairy supply chains.
- To explore the impact of disaster risk on dairy supply chains in Zimbabwe.
- To investigate collaboration strategies that are being implemented to reduce supply chain risks due to disasters in Zimbabwe.
- To determine the impact of private and public sector partnership efforts in disaster risk reduction on dairy supply chain performance in Zimbabwe.
- To ascertain factors that thwart disaster reduction in dairy supply chains in Zimbabwe.

I am hereby seeking your consent to gather data from 60km radius around the six milk producing cities/towns (Mutare, Chipinge, Harare, Kadoma, Gweru and Bulawayo). To assist you in reaching a decision, I have attached to this letter: Copies of the research instruments which I intend to use in my research.

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:

Felix Chari: charifelix93@gmail.com; +263 775994001

Dr Bethuel Ngcamu: NGCAMUB@cput.ac.za; +27795589794

Upon completion of the study, I undertake to provide you with a bound copy of the dissertation.

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

Chari Felix

Appendix XXV

All communications should be addressed to the "Director"

Reference:

MINISTRY OF AGRICULTURE, MECHANIZATION AND IRRIGATION DEVELOPMENT

Head Office
Bevan Building
18 Borrowdale Road
Harare
Email dlpd@africaonline.co.zw

DEPARTMENT OF LIVESTOCK PRODUCTION & DEVELOPMENT
Supporting the Livestock Industry

P. O. Box CY 2505
Causeway
Harare
Zimbabwe
Telephone: 791355
Fax : 764475

31 May 2016

Mr. F. Chari
Durban University of Technology

Dear Sir

APPLICATION FOR PERMISSION TO CONDUCT RESEARCH IN THE DIVISION OF LIVESTOCK PRODUCTION AND DEVELOPMENT.

Reference is made to your minute dated 24 May 2016.

I have approved that you conduct your research work in this Division's Dairy Services Unit. The Unit is in office number 37 Block 4, Makombe Building. Contact person details are as listed below-:

Mrs Marecha Chief Dairy Officer 0772120978

Mr Waniwa Dairy Officer 0772630129

[redacted]

Mr. B. Makodza
DIRECTOR LIVESTOCK PRODUCTION AND DEVELOPMENT

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, **Felix Chari** about the nature, conduct, benefits and risks of this study-Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Full Name of Participant	**Date**	**Time**	**Signature/ Right Thumbprint**

I, Felix Chari here with confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name of Researcher	**Date**	**Signature**

Full Name of Witness (If applicable)	**Date**	**Signature**

Appendix xxvi

LETTER OF INFORMATION

Title of the Research study: The assessment of disaster risk reduction strategies in dairy supply chains in Zimbabwe

Principal Investigator/researcher: Felix chari

Co-Investigator/supervisor: DR. Bethuel Sibongiseni Ngcamu (PHD: Higher Education, DTech: Public Management).

You are being invited to participate in an academic study on disaster risk reduction strategies in dairy supply chains in Zimbabwe due to your experience and knowledge in this field. In particular, this researcher is interested in finding the disaster risks prevalent in dairy supply chains, and the disaster risk reduction strategies in place.

The data gathering will take place at the respondent's place of work. This research will require approximately 1 hour of your time. There are no foreseeable risks or discomforts to participants in this study. If you wish to receive a copy of the results from this study, you may contact this researcher at the telephone number given below.

A participant may withdraw from the research process due to Non-compliance, illness, adverse reactions, etc. There will be no adverse consequences for the participant should they choose to withdraw from the research.

The participant will not receive any monetary or other types of remuneration. The participant is not expected to cover any costs towards the study except the time devoted to responding to questions.

Several steps will be taken to protect your anonymity and identity. While the responses will be recorded, the records will NOT contain any mention of your name, and any identifying information from the responses will be removed.

In case of any problems or queries please contact this researcher (+263775994001.), my supervisor (+27795589794/NGCAMUB@cput.ac.za.) or the Institutional Research Ethics Administrator on 031 3732375.ComplaintscanbereportedtotheDirector: Researchand Postgraduate Support,Prof S Moyo on 0313732577ormoyos@dut.ac.za

Thank you for your assistance in this important endeavour.

Yours sincerely