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PRO-POOR ADAPTATION TO CLIMATE VARIABILITY IN SEMI-ARID REGIONS OF ZIMBABWE: THE ROLE OF *ZIZIPHUS MAURITIANA* AND NETWORK INTERVENTIONS IN MUZARABANI DISTRICT.[1]

BY

ANYWAY KATANHA

A THESIS submitted to the **FACULTY OF SCIENCE**, at the **UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG,** in fulfilment of the requirements for the degree of **DOCTOR OF PHILOSOPHY in Geography and Environmental Studies**

SUPERVISOR: PROF. DANNY SIMATELE

JOHANNESBURG, 2018

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Ziziphus mauritiana (Zm)

DECLARATION

I, Anyway Katanha declare that this thesis, including data, tables, diagrams, graphs and any other information, is my own unaided work.

The thesis is being submitted for the Degree of Doctor of Philosophy in Geography and Environmental Studies to the Faculty of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any examination to any other University.

…….....(Signature of Candidate)

On the…….th day of.....2018

.....(Signature of Supervisor)

On the…….th day of.....2018

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ABSTRACT

The study seeks to interrogate the role that *Ziziphus mauritiana* plays, as a non- human actor, in building the adaptive and resilience capacity of poor people in Muzarabani of Zimbabwe through the lens of the Actor Network Theory (ANT) and Commodity Chain Analysis (CCA). The qualitative approach was largely used. Empirical evidence, which is largely the role that *Zm* plays in the adaptive capacity and resilience discourses on semi-arid space of Muzarabania as established by observations, interviews with diverse actors that included household heads, traditional leadership, civil society organisation (CSOs)and government department is presented in this thesis. The study revealed that there is a myriad of actors that form a complex web of adaptive and resilience capacity in *Zm* production, processing and marketing in Muzarabani. The analysis and discussion of the results places *Zm* into perspective, illustrating how *Zm* could enhance the adaptive capacity and resilience in Muzarabani if it were given the attention it deserves. Furthermore, the study revealed that local communities are not passive, as often portrayed, when they experience adverse weather conditions. Excluding them from processes that directly influence their day to day experience, for example the use of *Zm*, defeats all efforts to address environmental challenges. The case of *Zm* is argued with the lens of ANT. The study goes further "to unpack the black box" using ANT. Ultimately the research proposes the Actor Networked Eco-based Resilience Logic Model (ANELRM) as the framework that can catapult *Zm* to the right position in the adaptive capacity and resilience discourse in Muzarabani. The study further demonstrated another contribution to ANT that is it considers the natural resource *Ziziphus mauritiana* (*Zm)* as a non-linear commodity that needs to be followed closely to fully understand its contribution, contrary to the idea of taking natural resources as linear and static. ANT views power relations, not in terms of the physical power, but in terms of connections, offering a base to suggest it can, to some extent, address social inequality, exclusion and power dynamics which characterise local natural resource use. This is important to policy makers as they would understand better actors and the natural resources influencing community resilience after drought or floods. In context this will help government actors, like the Muzarabani Rural District Council, to come up with contextual policy measures and implementation efforts to address resilience challenges in semi-arid spaces of SSA, specifically in Zimbabwe.

Key Words: *Actor Network Theory, commodity chain analysis, eco-resources, human and non-human actors, resilience, Ziziphus mauritiana* (*Zm)*

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ABBREVIATIONS

AGRITEX	Agricultural Technical and Extension Services
ANERLM	Actor Networked Eco-based Resilience Logic Model
ANT	Actor Network Theory
CCA	Commodity Chain Analysis
CC	Climate Change
CPU	Civil Protection Unit
DA	District Administrator
DFID	Department for International Development
EMA	EnvironmentalManagement Agency
ENSO	El Niño–Southern Oscillations
FACHIG	Farmers Association of Community Self-Help Investment GroupsTrust
FAO	Food Agricultural Organisation
FCZ	Forestry Commission of Zimbabwe
F	Frequency
GT	Grounded Theory
GCC	Global Commodity Chain
GPN	Global Production Network
IFRC	International Federation of the Red Cross
IPCC	Intergovernmental Panel on Climate Change
MA	Millennium Ecosystem Assessment
MRDC	Muzarabani Rural District Council
NGOs	Non-Governmental Organisations
Pers.com	Personal communication
SAFIRE	Southern Alliance for Indigenous Resources
SSA	Sub-Saharan Africa
SLF	Sustainable Livelihoods Framework
UNISDR	United Nations International Strategy for Disaster Reduction
UK	United Kingdom
WFP	World Food Programme

WRI	World Resource Institute
ZIMSTAT Agency	Zimbabwe National Statistical
Zm	*Ziziphus mauritiana*
ZRP	Zimbabwe Republic Police

CHAPTER 1

FRAMES OF REFERENCE

1.0 Introduction

This chapter presents the perspective of the study. It starts with the background of the study by exploring the global, African, Southern African and the Zimbabwean climate variability experiences. The chapter further presents the problem statement and thrust, which presents the problem at hand, its relevance, significance, and discusses the main theoretical, practical as well as empirical reasons for conducting this study. It then provides details of the research questions and objectives and the main question that the present study endeavors to answer. The chapter concludes with a precise overview of the thesis composition.

Climate variability has resulted in the loss of property and lives across the globe, from lesser developed countries such as Bangladesh, Sudan, Madagascar, Malawi, Mozambique, to amongst the most advanced, such as Britain, Canada, France, the Netherlands and the United States of America(Neisser, 2014). According to the Intergovernmental Panel on Climate Change(IPCC), (2014) contemporary climate change assessments for Africa suggest that the continent is highly susceptible to climate variability. Numerous problems contribute to this susceptibility, including poor infrastructure, problematic governance, extraordinarily high poverty levels, an ever-increasing population and continual natural hazards for example: droughts, floods and an overdependence on rain-reliant agriculture (Dwiartama & Rosin, 2014; IPCC, 2014; Mavhura, 2014; Kenney *et al.*, 2015). Sub-Saharan Africa will continue to be negatively impacted by droughts and floods.

In Southern Africa, there have been harsh droughts, similar to those of 1982–1983 and 1997–1998 linked to the El Niño–Southern Oscillations (ENSO), which have caused significant hardships for the rural poor (IPCC, 2013). Zimbabwe has suffered recurrent devastating alternate periods of drought and flood (Chazovachii *et al.,* 2012; Kadzere & Jackson, 1998).Gwimbi (2004), reports that in 2000, the semi-arid regions in Zimbabwe suffered the worst flooding in their history. The IPCC (2014) on the other hand states that droughts and floods are likely to increase in terms of magnitude and frequency during the 21st century. Consequently, the increasing loss of lives and economic toll, primarily due to droughts and floods over the past decades, are bound to rise towards unmanageable levels(United Nations International Strategy for Disaster Reduction (UNISDR), 2009a). The United Nations International Strategy for Disaster Reduction called for greater efforts in mitigating and responding to effects of climate variability claims (Berman *et al.*, 2014; Dwiartama & Rosin, 2014; Neisser, 2014; UNISDR, 2009a, 2009b). Lacking other options, many impoverished rural inhabitants must turn to available natural resources to maintain their resilience and adaptive capabilities (Kadzere & Jackson, 1998; Musarurwa & Lunga, 2012).

The uses of wild fruits are an integral part of many rural communities in Africa's semi-arid regions and in other developing nations of the world states (FAO, 2015; Nyanga *et al.,* 2013). Mithöfer *et al.*, (2006) noted that in Zimbabwe, the gathering, processing, storage and marketing of native fruits are remarkable coping approaches embraced by rural communities to recover

from environmental stresses. Derived from fruits are income, subsistence consumption supplies, ecological balance and products such as medicines, fibre and in remote cases, firewood (Shackleton *et al.,* 2015). Hence peoples' engagement to *Ziziphus mauritiana* (*Zm*) sustainable use and management in Muzarabani is vital. The products of wild fruit trees are used for social and entertaining devotions (Kars & Jacobson, 2012). In Zimbabwe, the *Zm* grows in different environments, however, it grows widely and fruits well in the low-lying areas that include the northern semi-arid region: amongst which are; Guruve, Mt Darwin and Muzarabani districts (Nyanga *et al.,* 2013). In the local language, Chikorekore *Zm* is known as *Masau*, and their harvesting period is between June and September. *Zm* produces edible fruits which are green-yellow when ripe and eventually turn brownish when dried. They are part of the savannah forest patterns that forge mutually valuable associations, creating a rural ecosystem that is more than the parts of its sum. Some studies have been conducted in Zimbabwe to advance the post-fruitage quality of the *Zm* (*masau*) fruit (Tembo *et al*., 2008), and on the traditional processing of the fruit (Nyanga *et al.,* 2008).

Comprehending the *Zm* and its related actors helps the scholarly world gain insight into how a local fruit can make a difference in the day to day experiences in semi-arid regions. However, the convincing basis of this comprehension is weak (Shackleton *et al.,* 2015). Most of the research conducted to ascertain the dependency of households on fruit trees and the correlated socio-economic issues did not embrace an analysis of the complex networks embedded in the use of the local wild fruits. Various academic studies have struggled to value natural/ fruit tree resources. Known studies of this nature were conducted in Asia and parts of South America. Of late, interest has been paid to the potential use values of wild fruit trees in semi-arid savannas environments (Shackleton *et al.,* 2015)

1.1 Problem statement

The impacts of climate variability in Muzarabani District are a force to be reckoned with because of increased temperatures, water scarcity, pest, and diseases (Enete & Amusa, 2010; Kadzere & Jackson, 1998). Muzarabani is more susceptible to the effects of climate variability than the rest of the country, mainly because of the flooding and drought experienced (Manyanye, 2015; Mavhura, *et al.,* 2015). Once-fertile soils battle with either flood or drought that recurrently occurs in Muzarabani (Mavhura *et al*., 2015). The poor peasant communities are most likely to be affected by climate variability impacts because their livelihood relies on rain-fed agriculture. Muzarabani is considered to be one of the most climate-vulnerable parts of Zimbabwe and is extremely vulnerable to agricultural failure (Mavhura *et al.,* 2015; Ebhuoma & Simatele, 2017; Maruza *et al*., 2017). The Muzarabani community represents an appalling example of how rural communities adapt to semi-arid spaces and cope with adversities that disturb their livelihood. Studies revealed that a sizeable proportion of people in Muzarabani is food insecure (Maruza *et al.,* 2017; Shackleton *et al*., 2015) and suffer from the effects of either drought or floods (Berman *et al.,* 2014), a fact portrayed as hidden hunger.

The complex increase in food insecurity at household and community levels has compromised poor people's adaptive capacity to endure climate variability impacts in Muzarabani (Ebhuoma & Simatele, 2017; Maruza *et al.,* 2017; IPCC, 2013;Nyanga *et al*., 2012). Despite the impacts of climate variability in Muzarabani on the livelihoods of the poor rural households, they are

actively involved in looking for ways in which to adapt to the subsequent challenges. One of the strategies is turning to eco-services through hunting and the collection of wild edibles which include wild fruits, roots and vegetables. Out of the many plants, one key plant used as a source of livelihood by the Muzarabani community is the *Zm*, locally known as *Masau*.

The geographic location of Muzarabani has turned the semi-arid zone into a key hotspot of *Zm* production (Maruza *et al*., 2017; Tembo *et al*., 2008). Though semi-arid, Muzarabani is an ecologically rich zone because of the blend of *Zm*, savannah forests, wildlife, agricultural lands, and economic performance such as off farming. In Zimbabwe, wild fruits are an important source of food, dietary snacks, income and are also used for barter trade. *Zm* is predominantly gathered from homesteads, gardens, cultivated fields and the veldt. The major role of *Zm* is the provision of edible fruits, raw materials for beer brewing and for non-alcoholic beverages. Studies conducted on indigenous wild fruits have revealed that they have comparatively higher levels of micronutrients than the conventionally grown species (Ndlovu & Afolayan, 2008; Nyanga *et al.,* 2013; Steyn *et al.,* 2001). *Zm* grows naturally, is locally accessible and inexpensive for the poor communities to grow (Maruza *et al.,* 2017). Recent studies specify that wild fruits still play noteworthy roles in food security, medicine and nutrition (Maruza *et al.,* 2017). *Zm* offers a basis of livelihood in difficult times caused by climate variability in semi- arid regions. Lately, *Zm* medicinal properties are under scientific verification (Nyanga *et al*., 2012; Dahiru *et al*., 2006). *Zm* have been utilised by the Muzarabani community for food, alcoholic and non-alcoholic beverage for centuries.

In spite of their good nutritional value*, Zm* has not been comprehensively domesticated and is not cultivated commercially, especially in Zimbabwe (Nyanga *et al*., 2012). Actors involved in the production, use and trade of *Zm*, are not well understood and known. The thrust of this thesis is to present an understanding of the role of *Zm* use as well as the ecological, social, economic and political dynamics shaped by the interaction of different actors in Muzarabani. Essentially, gaps between eco-based responses to natural hazards in the Muzarabani district, Zimbabwe exist. In view of these arguments, **this study sought to explore the role of *Zm* in contribution to the livelihood portfolios of the poor people in Muzarabani District; and secondly to investigate the role of *Zm* in building the adaptive capacity and resilience of the poor people in Muzarabani against the impacts of climate variability using the Actor Network Theory (ANT).** In light of the above background, the following research questions guided the study process:

i. What are the contributions of *Zm* to livelihoods and its role in adaptive capacityresilience through an analysis of the networks associated with it?

ii. What are the inferences and significances of formal and informal institutional arrangements related to access and utilization of *Zm* by local communities?

iii. How can Actor Network Theory (ANT) be used to enhance or act as an alternative approach to the understanding of adaptive capacity resilience of rural communities in the Muzarabani District, Zimbabwe?

1.2 Research aims and objectives

The aims of this study were twofold: firstly, to investigate the role of *Zm* in contribution to the livelihood portfolios of the poor people in Muzarabani District; and secondly, to investigate the role of *Zm* in building the adaptive capacity and resilience of the poor people in Muzarabani District against the impacts of climate variability using the Actor Network Theory (ANT).

In light of the identified aims, the objectives of the study were to:

i. Assess the contribution of *Zm* to livelihoods and its role in building the adaptive capacity and resilience of the poor rural people through an analysis of the networks associated with it.

ii. Assess the inferences and significances of formal and informal institutional arrangements related to access and utilization of *Zm* by local communities.

iii. Examine the use of ANT as an approach that could enhance the adaptive capacity and resilience of the poor people in the Muzarabani District, Zimbabwe.

1.2.1 Gaps in Knowledge

Resilience and adaptative capacity strategies are meant to reduce the suffering or loss of life and properties by having the capacity to recover after a shock or hazard; regrettably, the real world is burdened with recurrent hazards (Hulme *et al.,* 2000; Kenney *et al*., 2015; Neisser, 2014), repeatedly worrying the same community in a menacing and harsh way. However, there is limited empirical research on building resilience and adaptative capacity approaches that place Actor Network Theory(ANT) into perspective (Hulme *et al.,* 2000; Neisser, 2014). ANT has been used successfully in other disciplines such as tourism, information and technology (Murdoch, 2001; Gonzalez, 2013). However, it has hardly been used to enhance the understanding of building resilience and adaptative capacity strategies in Zimbabwe, Sub Saharan Africa and the world.

The engineering and non-structural resilience strategies initiatives, in most cases, have failed to yield the intended results. Research on hazards has been conducted, but very little seems to be providing comprehensive enhancement of resilience and adaptative capacity approaches underpinned by complex socio-ecological networks (Elizabeth *et al*., 2014; Neisser, 2014; Gwimbi, 2004; Madamombe, 2004). One of the most compelling reasons for choosing to focus on this fruit tree *Zm* is that, in this particular district, it is such an important part of the daily lives of its inhabitants. The Disrict is 'intimately linked' to this non-human actor (Kadzere & Jackson, 1998). It is also widely suggested that there is a need to incorporate different actors both human and non-human in resilience and adaptative capacity strategies options (Elizabeth *et al*., 2014; Neisser, 2014; Wisner *et al*., 2004). Differentgovernments have included various actors, non-governmental organisations, natural resources, women and the community, concepts in developing resilience and adaptative capacity strategies (Elizabeth *et al*., 2014; Neisser, 2014; Gonzalez, 2013). Therefore, it is imperative to comprehend the identified actors' complexities and the networks that can stabiliselivelihood, adaptation and resilience options.

In Zimbabwe, its failed policies (Framework for Economic Reform (1991-95), Economic Structural Adjustment (ESAP 1991-2000), Zimbabwe Programme for Economic and Social Transformation, (ZIMPREST 1996-2000), Community Areas Management Programmes for Indigenous Resources, (CAMPFIRE), and the one currently being tested, Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset), present a unique resilience and adaptative capacity strategies landscape (Elizabeth *et al.*, 2014). It is no surprise that there is limited research on livelihood, adaptation and resilience options of fragile environments like Muzarabani. The paucity and poor implementation of existing adaptive and resilience policies are some of the handicaps to research capacity in Zimbabwe. This has translated into little if any research that would yield information, which could lead to innovative resilience and adaptative capacity strategies. In addition, the study explores various institutions in the day to day use of *Zm* in the area subjected to climate variability. This study attempts to widen the prevailing body of knowledge on the building of the poor people's adaptive and resilience capacity.The ANT is used to explain complex actor's relationships in the area under study. The section below detailsthe theoretical consideration and literature reviewed.

1.3 Theoretical consideration and literature review

The research made use of an array of concepts and approaches for research and to explain the findings. The following theoretical means were used: ANT, CCA, SLF and resilience approach. The mentioned approaches are affiliates of the family of theories known as praxeological (Reckwitz, 2002). The approaches were used as a route to propose an alternative viewpoint that could enhance our contemporary consideration of eco-based climate adaptation and resilience approaches from semi-arid regions. According to Watkiss & Cimato (2016),these approaches can withstand some of the flaws in scholarship which have commonly followed the traditional thinking and suggest a broader understanding of the phenomena. This is done by foregrounding the complex interactive, collective, historical and dynamic shaped nature of the phenomena.

The praxeological group of theories is broad and offers different methods and these include: the Actor-Network Theory (ANT), Commodity Chain Analysis approaches (CCA), and Sustainable Livelihoods Framework approach (SLF) used in this study. The mentioned approaches have different theoretical backgrounds and at times rather incoherent attractions (Watkiss & Cimato, 2016; Reckwitz, 2002), so that it is vital to stipulate when to use a specific praxeological approach to evade the considerable variances between them (Reckwitz, 2002). However, what is common to all these approaches is that they offer primary consideration to such issues as actors, relations, practice, context and situation (Dwiartama & Rosin, 2014). In support of this view (Reckwitz, 2002) suggests that the main difference between praxeological approaches and other social theory approaches is their promising options that complement perspectives that are inclined by traditional thinking.

Initially, the concept of adaptation and resilience approaches was engaged in interpretation as a theoretical focus. This idea assumes that adaptation and resilience involve the use of resources and different actors. The structural approach seems to be the traditional and more commonly used approach to livelihood, adaptation and resilience. However, because of reasons explained in chapter 2, the approach contains flaws. The study, therefore, suggested that engagement to a non-structural approach may influence the understanding of the livelihood, adaptation and

resilience discourse.Resilience, livelihood, and adaptation strategies are a relatively minor priority to most African policymakers (Mutekwa, 2009; Sergio *et al.*, 2012; Timothy *et al.*, 2014). Zimbabwe has a climate change strategy in place and although there is widespread misunderstanding of how mitigation approaches can be enhanced (Adger, 2009; Dwiartama & Rosin, 2014; Kenney *et al.*, 2015; Lindell *et al.,* 2006; Madamombe 2004; Mavhura, 2014; Neisser, 1996; Neisser, 2014). In addition to the above, livelihood, adaptation and resilience materialises through an array of effects that include human and non-human actors. These actors include: people, state, non-governmental institutions, technology and even eco-resources such as *Zm*.

Naturally, people have a tendency to care for the two, human and non-human, as separate (Latour, 1997; Law, 1992). This research argues that the globe of livelihood, adaptation and resilience approaches is considerably heterogeneous (Latour, 1997). The truth is however, far more complex. Lack of understanding, confusion and power struggles amongst local traditional leaders, politicians, scholars, governments and non-governmental institutions contribute to the problematic attempts to implement effective livelihood, adaptation and resilience approaches in Muzarabani District (Dwiartama & Rosin, 2014; Kadzere & Jackson, 1998; Madamombe, 2004; Mavhura *et al.*, 2015). The partnerships between local people, activists, the local government and other actors have not helped the problems associated with hazards (Agrawal *et al.,* 2008; Sergio *et al.,* 2012). In this research, the intention was to present a different approach to livelihood, adaptation and resilience that considered both human and non-human actors as important (Callon & Latour, 1992; Law, 1999). This was an attempt to comprehend and organise the complex interrelationships of people, possessions, the natural world and culture in livelihood, adaptation and resilience discourse.

Actor-Network Theory (ANT) offers a way to enhance the understanding of livelihood, adaptation and resilience approaches (Callon, 1986; Latour, 2005; Law, 1992). Within this study, the research took note of lessons learnt from fields like sociology of science and technology to geography that have utilized ANT. In most developed countries such as the Netherlands, the United Kingdom, and the United States of America, Actor-Network Theory (ANT) has passed from the sociology of science and technology to, for example, tourism studies, information and technology and development sociology (Blok, 2010; Dwiartama & Rosin, 2014; Fink & Weyer, 2014; Gibran, 2013; Kenney *et al.,* 2015; Mol, 1999). Actor-Network Theory provides an opportunity for scrutinising human and non-human agencies (actors) and the resulting effects of interaction, so that scholars and environmentalists may better understand and find effective solutions or responses to livelihood, adaptation and resilience (Kenney *et al.,* 2015; Latour, 2005). To date, most scholars, policy-planners and those responsible for implementing livelihood, adaptation and resilience policies, have limited engagement to the larger web of interaction, instead they focus their attention primarily on affected communities only (Bandara & Cai, 2014; Kinnear *et al.*, 2013; Sergio *et al.*, 2012). ANT is a constructive tool that helps to provide new insights into human actors and the space dynamics and interactions of the complex socio-ecosystem (Elizabeth *et al.*, 2014; Kinnear *et al.,* 2013). Engaging the web of interactions preserves the probability of mutual aid and multiparty action, which in practice could assist in implementing livelihood, adaptation and resilience strategies (Bodin *et al.,* 2006; Latour, 2005).This study offers a more all-embracing approach based on the principle of symmetry and translation inherent in ANT. While ANT has its critics, Latour (2005); Callon & Latour (1992)

and Amsterdamska (1990), maintain that many criticisms are based on misinterpretations of the theory.

Complex interlinkages of different actors in Muzarabani required the formulation of additional approaches of thinking pertaining to the day to day livelihood strategies. The livelihood valuation tools were used to enhance the understanding of the Muzarabani community. "Sustainable livelihoods framework" denotes a livelihood valuation tool or concept supported by the British led Department for International Development and academics like (Chambers & Conway, 1991; Krantz, 2001; Geiser *et al.*, 2011). The concept is known in academic literature as the blue print for reducing poverty. Sustainable livelihoods integrate an array of asset portfolios, processes, constructions, vulnerabilities and settings (Adger *et al.,* 2009; Williams & Micallef, 2009). The concept allowed the all-inclusive consideration of poverty levels of the families in Muzarabani. A livelihood incorporates the capabilities, natural or economic or social capitals, and undertakings vital for a means of living. In addition, it is considered sustainable when livelihoods can manage, and pull through from environmental shocks and uphold its abilities, both in the near or far future, whilst not depriving the natural resource base (Madzwamuse, 2010; Peacock *et al.*, 2009). Chapter 2 forms part of the further explanation of the sustainable livelihood framework.. The livelihood framework demonstrates how societies function within a vulnerable setting shaped by various factors, which include the different types of capital such as the natural or social capital. Interrelationships are also taken into consideration with the view of attaining positive livelihood results. In focusing on the activities that frame the use of *Ziziphus mauritana*, the Commodity Chain approach has the potential to advise participation, sustained by shared technologies in communities in semi-arid regions. Additionally, characteristics such as relations between actors, the history of the actor's relationship, trust, fairness, space and competition render the potential for a fruitful perspective of contribution in natural hazard mitigation in the semi-arid discourse. The Sustainable Livelihoods Framework (SLF) view of many inclusions was a valued resource to discover how the Muzarabani community was showing multiple options to increase their livelihoods. In context, SLF was showing multiple options to increase their livelihoods. The use of *Zm* and how it shapes the actions of various actors.

Commodity Chain approaches was also a theoretical substitute to inform the scholarly work discussed in this study. The core idea of Commodity Chain Analysis (CCA) is that actors from different backgrounds participate in numerous activities, which nurture their identity and use of *Zm*. Thus, it is proposed that in order to comprehend the vulnerable community, it is necessary to identify all the activities and actors in the vulnerable space. However, without overlooking the potential significance of CCA to inform the contemporary study, preference was given to the ANT. These theoretical contributions enhanced understanding in this study. An example from the study is how the same *Zm* is perceived in a different way by various actors and how this nurtures the community's adaptation to climate variability in Muzarabani. In addition, activities were identified to include *kachusu* brewing and how it requires the implementation of technologies, which might improve or put at risk the livelihoods of the Muzarabani community. How the presence of diverse opposing actors might weaken or strengthen the use of *Zm* or the adoption of *kachusu* brewing technologies was also identified. It was noted that some actors use power to produce, harvest, market or barter trade *Zm*. The study also revealed the means by which the lack of enrollment of applicable actors influences the non-use of *Zm* and related

technologies. Furthermore, the manner and time when the benefits of *Zm* on specific trade are not aligned to the interests of potential users was looked at. Finally, it was identified in the study how the trade of *Zm* is affected by the discussions or interactions that take place among relevant actors.Further contributions and criticisms of the theoretical resources used are discussed in Chapter 2.

1.4 Methodological approach

The study used an ethnographic approach to provide insights into the Dambakurima community's use of *Zm*, livelihood, adaptation and resilience strategies, experience and related actors in Muzarabani District. For analysis, the study embraced a blend of qualitative methods: Actor Network Theory (ANT), document analysis, ethnography grounded theory (GT) and Commodity Chain Analysis (CCA). The methodological difference between this particular research study and other related research studies in geography and environmental studies, was the use of ANT as a method and as a means of analysis. The summary of the methodology is presented below in Figure 1:1.

The literature review and philosophical considerations helped the researcher to select the theoretical concepts and later for conceptual framework construction.

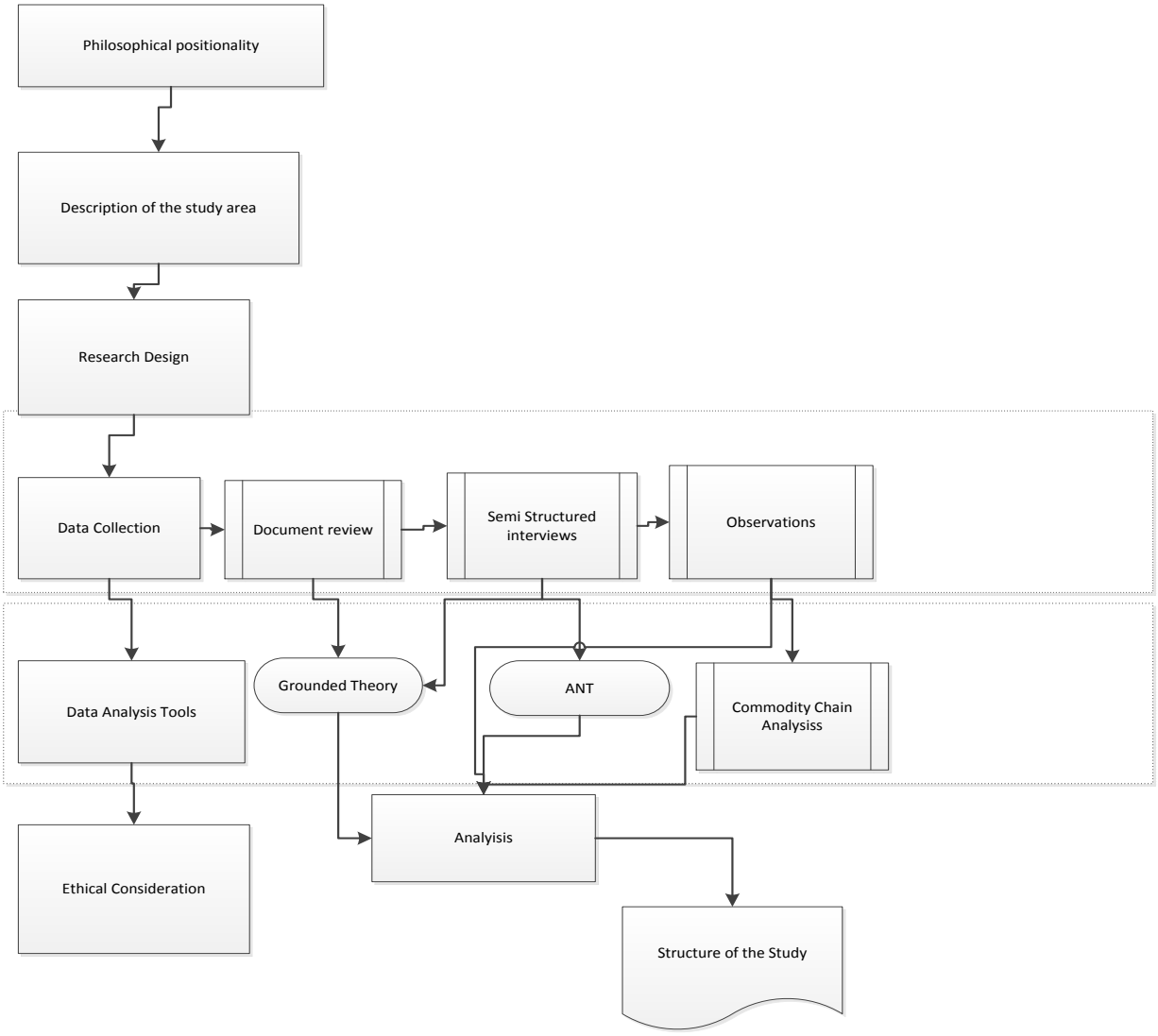


Figure 1. 1: Summary of Methodology by Flow Chart

Source: Field data 2016

The study used a qualitative approach to track the actors in the course of their network creation, their efforts to construct stronger ties; to observe how they compromise, bargain, and scheme, unite, and compress their relations; how translations occurred and what was actually being translated. The research followed both human and non-human actors in their diverse networks, and made an effort to record how they mobilised, contrasted, and held together. This helped the research to capture an in-depth background of different actors (Latour, 2005). The research used Grounded Theory (GT); Actor Network Theory (ANT) and Commodity Chain Analysis (CCA) approaches to understand the *Zm* network production and its meaning in eco-based livelihood, adaptation and resilience options. Actor Network Theory (ANT) focused upon how translation and enrolment occurred (Latour, 2005; Alcadipani & Hassard, 2010). In line with ANT thinking, this study made use of human actors and non-human actors. The qualitative procedure used to solicit data was systematic and articulated the study's research statement, aims and objectives. The following research tools and methods were used during the data collection namely: the

document review, semi-structured interviews and observations. These are discussed in Chapter 3 (Methodology section). Pre-study meetings with people in the study area were conducted to help shape the research questions. Access to the field was gained through structured interviews (Babbie, 2002).

The GT approach was used to analyse qualitative data and assist in understanding how it needed support to clarify complex interactions. It was used together with ANT and CCA in order to guide the process of data analysis (Strauss & Corbin, 1990). The main reason for mixing ANT, CCA and GT lay in the anticipated complexities of data in Muzarabani, which called for different analytical approaches. The three were fundamental methods for research of subjective experience and meaning. Grounded Theory (GT) enabled an iterative coding process that identified the emerging concepts. GT then examined empirical evidence for the coding support, consolidating similar concepts, and collecting more data until theoretical saturation was reached. Data analysis was based on the open coding, axial coding, and selective coding (Sarker & Sidorova, 2006). Attention was given to non-human actors like *Zm* and the exploration of their roles by tracing associated actors and networks. The ANT allowed the study of actors as they presented themselves, rather than being controlled to a predefined theoretical context.Callon & Latour (1992) suggest that the actors scale, power and motives behind actions are not all predetermined.

1.5 Scope of the study

The study focused on *Zm*, a multipurpose evergreen fruit tree found in Muzarabani. Network patterns that have played an unnoticed or unacknowledged role in mitigation and adaptation strategies employed in Muzarabani were also part of the scope of the study. The study used the ANT, the Commodity Chain analysis and sustainable livelihoods framework to unearth the complex interactions entangled with the use of *Zm*. Particular attention was paid to how, during hazards, the Muzarabani community depended on *Zm's* ecological services that include providing a safety zone, as a source of income which they use to procure food, education, health and social services. The tree also has medicinal properties and is used to treat those afflicted with numerous diseases after hazards. *Zm*'s adaptation to essential elements was part of the research's delimitation. The importance and commercial value of indigenous fruits has been disregarded (Bouwer *et al*., 2011; Hochrainer *et al*., 2010; Saka *et al*., 2007; Tembo *et al*., 2008). The study put into perspective the fact that despite being part of the eco-resources that provide for human needs, research on the role of *Zm* as an important actor in the livelihood, adaptation and resilience landscape of Muzarabani remains scant.

The dynamics and nature of the *Zm* were used as a vehicle to explore how the community could plan to reduce suffering after hazards. In this study, *Zm* was regarded as an investment with yet to be explored societal and environmental rewards. *Zm* as a non-human actor was considered in its explicit state, in an endeavour to explain the enhancement of adaptation approaches in Muzarabani.

1.6 Ethical considerations

The experiences of ethnographic researchers such as Neuman (2011), suggest that access to fieldwork settings should be of major consideration in planning a study. An ethical clearance certificate Protocol Number: **H15/07/22** was used from the University of the Witwatersrand. Formal and informal access request letters, describing the purpose of the study, were sought prior to the commencement of the study. The anonymity of respondents was guaranteed. The request for all actors was based on honest and straightforward traits. The researcher promised to give feedback and a copy of the study's findings to representatives of all participants. It was highlighted that the study was only interested in *Zm* use, actor networks and how they shaped resilience strategies in Muzarabani. Results from the study were purely for academic purposes. Data solicited was analysed using the appropriate analytical methods. Letters of introduction for carrying out the study in Muzarabani were sought from the University of the Witwatersrand ethics review board and Muzarabani Rural District Council.

1.7 Structure of the thesis

This thesis is arranged into six chapters and is by monograph. **Chapter 1** discusses the conceptualisation of the study. It is within this chapter that the aims of the study, research questions, justification, the scope, methodology and the structure of the study are stated and discussed. **Chapter 2** examines the Actor Network Theory (ANT)'s use as well as its criticisim. The chapter further explores some existing broader earlier literature of livelihood, adaptation and resilience approaches. **Chapter 3** presents the methods used in the thesis. The philosophical underpinning and various methodologies linked with ANT are discussed. It focuses on the application of ANT as a methodological imperative to improve the understanding of eco-based resilience or livelihood, adaptation and resilience strategies in the Muzarabani District of Zimbabwe. **Chapter 4** provides empirical evidence on the uses and the engagement of actors in *Zm* that are needed to improve the livelihoods and resilience of rural poor affected by natural hazards. The various actors involved in the use and management of *Zm* are explored in the context of their interactions as well as their contribution.**Chapter 5** analyses and discusses the empirical evidence. It further explores and analyses the ANT and relevant theoretical framework(s), such as the CCA and SLF that enable the understanding of *Zm* as alternative eco-based resilient approach. **Chapter 6** consists of the summary, key contributions, conclusions and recommendations of the study. The chapter specifies the attainment of the objectives of the study, despite some limitations associated with the procedure followed.

CHAPTER 2 [1]

THEORETICAL CONSIDERATIONS AND LITERATURE REVIEW

2.0 Introduction

The purpose of this chapter is to critically review theoretical resilience and livelihoods concepts and approaches. Comprehensive resilience and livelihood documentations are vital for the examination of precedent events, their impacts and responses (Kreibich *et al.*, 2005; schröter *et al.,* 2015). The review is contextualised to fit a global perspective, highlighting the African experiences in semi-arid zones (Alesch, 2004; Quandt *et al.,* 2017; Thomas & James, 2006). For instance, developing countries experience a higher loss of lives, while developed countries experience more economic losses (Mileti, 1999; Thomas & James, 2006). However, similar concerns exist around questions about the impacts and experiences. When questions such as "who is impacted?" are asked, how does someone respond to the difficult experiences caused by hazards using available natural resources and other actors? In the course of this review, an overview of the resilience and livelihood approaches is discussed (Mileti, 1999). This is followed by a summary of the role of *Ziziphus mauritiana*, and the Actor Networks Theory's potential to enhance the understanding of adaptations and resilience options. The review glides into an argument of recent unique understandings of the role of both human and non-human actors in any process. ANT can also demonstrate practically its value in rendering a theoretically informed method to sampling (by mapping on actors that are linked to the eco-resource in question (*Ziziphus mauritiana*) and analysis (by providing a theoretical tool and terminology that can be the centre for explanations). The ANT is explored from an ecological service perspective, arguing that in order forlivelihood, adaptation and resilience to be effective, it must be considered together with other actors in the discourse.

2.1 Background of semi-arid regions

Globally, remote semi-arid communities experience food and nutritional challenges due to recurrent natural hazards (UNISDR, 2009a). Guaranteeing food security and nutrition has been a daunting task for many developing countries despite global measures to enhance agriculture yields, distribution and identification of suitable policies (FAO, 2011). The challenge is complex, calling for a radical approach that considers food production and availability, distribution, accessibility and choice, and bearing in mind the influence of the socio-economic standing, geography, commodity chains, history and cultural imperatives in specific contexts. Population

[1] This chapter is based on a paper that was presented at an international conference entitled "Future Agriculture: Social-ecological transitions and bio-cultural shifts September 20 - 22, 2017", and held at Bonn University in Germany 2017. The paper has been published as part of the conference proceedings and appears as: Katanha A and Simatele D, (2017) Natural Hazard Mitigation Strategies Review: Actor Network Theory and the Eco-based Approach Understanding in Zimbabwe ISBN: 978-37369—9612-0.http://www.tropentag.de/abstract.php?code=DisUmaifor http://www.tropentag.de/2017/abstracts/posters/183.pdf

growth and pressure on available resources have only worsened the plight of the rural poor in semi-arid zones (Manyanye, 2015; Neisser, 2014). However, communities in these semi-arid spaces are not passive actors as often documented in the literature but are actively involved in improving their livelihoods by turning to eco-resources such as *Zm* (Ebhuoma & Simatele, 2017). Climate variability and resilience studies have distinguished and emphasised the importance of eco-resources and other asset portfolios such as the socio-economic, in building the adaptive capacity and resilience of the poor to the effects of climate change induced natural hazards (Doherty *et al.*, 2017; Faye *et al.,* 2011).

Rural poor communities throughout the world, particularly those in semi-arid spaces, use a wide range of wild fruit trees for food, income generation and medicinal purposes (Illgner & Nel, 2000; Shackleton & Shackleton, 2004; Belcher *et al.,* 2005). Within the context of sub-Saharan Africa for example, it is estimated that 600 million poor and food insecure people are reliant directly or indirectly on wild fruit trees for food, beverages and income generation (Faye, Weber, Mounkoro, & Dakouo, 2010; Foli *et al.,* 2014). In southern Africa, the contribution of wild fruits to income ranges from 20% to slightly over 50% (Fisher, 2004; Kinnear *et al.*, 2013). Wild fruits are gathered with minimum economic cost and do not require advanced and expensive inputs and technology, meaning that the initial asset in production is not an issue to successful outcomes (Agrawal & Gibson, 1999; Kalinganire, *et al.*, 2008).

Recent eco-friendly discourses and arguments appeal for the integrated use and sustainable management of wild fruits as a way of promoting their effective distribution to improve rural poor people's adaptive capacity and resilience against the impacts of climatic variations and other internal and external stressors (Petersen & Silveira, 2017; Shackleton & Shackleton, 2012; Tompkins & Adger, 2004). Shackleton & Shackleton (2012), for example, argue for the need to identify an integrated eco-resource management approach that would facilitate the merging of cultural, social, ecological, and economic development with a view to promoting the effective use of natural resources, while at the same time contributing to building the adaptive abilities of local people against different kinds of stresses (e.g. climate variability). Echoing this argument, Reed *et al., (*2017) are of the view that wild fruit tree management principles and tools should be developed in a manner that effectively informs decision-making processes taking into account the different uses of the wild fruit trees to local communities and their wider context (Bharucha & Pretty, 2010).

Despite the importance that wild fruits play in poor rural communities as a source of food, the recognition of *Zm* as a source of livelihood during perilous periods and its contribution to the adaptive capacity and resilience of the poor has been neglected or poorly understood. Much of the existing research on the importance of *Zm* has paid attention to its use as an ingredient in the making of alcoholic local beverages such as *kachasu* and not as a source of food and income generation (Maruza *et al.,* 2017; Mukhtar *et al.,* 2004; Tembo *et al.,* 2008). This chapter therefore, is an attempt to contextualise the importance of *Zm* in a wider context and uses the Actor-Network Theory (ANT) as an analytical framework to identify the role that this wild fruit tree plays in contributing to building the adaptive capacity and resilience of poor rural households in Muzarabani District against the impacts of climate variability. It is argued in the chapter that understanding the extent to which *Zm* (a locally embedded eco-resource tree) can positively contribute to the livelihood options of rural households and their adaptive capacity and resilience

against climate variability requires the development of an enabling institutional and policy environment within which the ambitions and aspirations of the poor can be fostered, propagated and enhanced in order to fully capture the benefits of eco-resources. This will require a process of policy integration viewed from a holistic perspective complementing grass-root initiatives, local and national government development agendas.

2.1.1 Climate change, eco-services, Actor-Network Theory (ANT) and community resilience

Sub-Saharan Africa is endowed with natural resourceswhich the majority of poor rural households depend on for their livelihoods and income generation. Existing literature documents that rural households throughout less economically developed countries use food, fuel, fodder, construction materials, medicine and other products from forests and other natural, non-cultivated environments to meet subsistence needs and generate cash income (Angelsen *et al.,* 2014). Wunder *et al*., (2014)for example, note that an estimated 77% of rural households in developing countries depend and draw their livelihoods and incomes from the natural forests. These services rendered by the natural environment have been identified and labeled within a number of seminal studies as "the hidden harvest" and refer to a myriad portfolio of eco-services and goods provided freely from the environment (Scoones, 1992; Cambero & Sowlati, 2014). According to Angelsen *et al*., (2014), eco-services provide three main functions in supporting the livelihoods and wellbeing of rural households and these are: supporting contemporary consumption patterns of households and communities; providing safety-nets in response to both internal and external shocks including gap-filling of seasonal shortfalls; and finally providing an avenue to accumulate productive assets which are then ploughed into efforts to reduce the prevalence of household and community poverty. The Figure 2.1 shows how an eco-resource can build resilience and adaptation to climate variability.

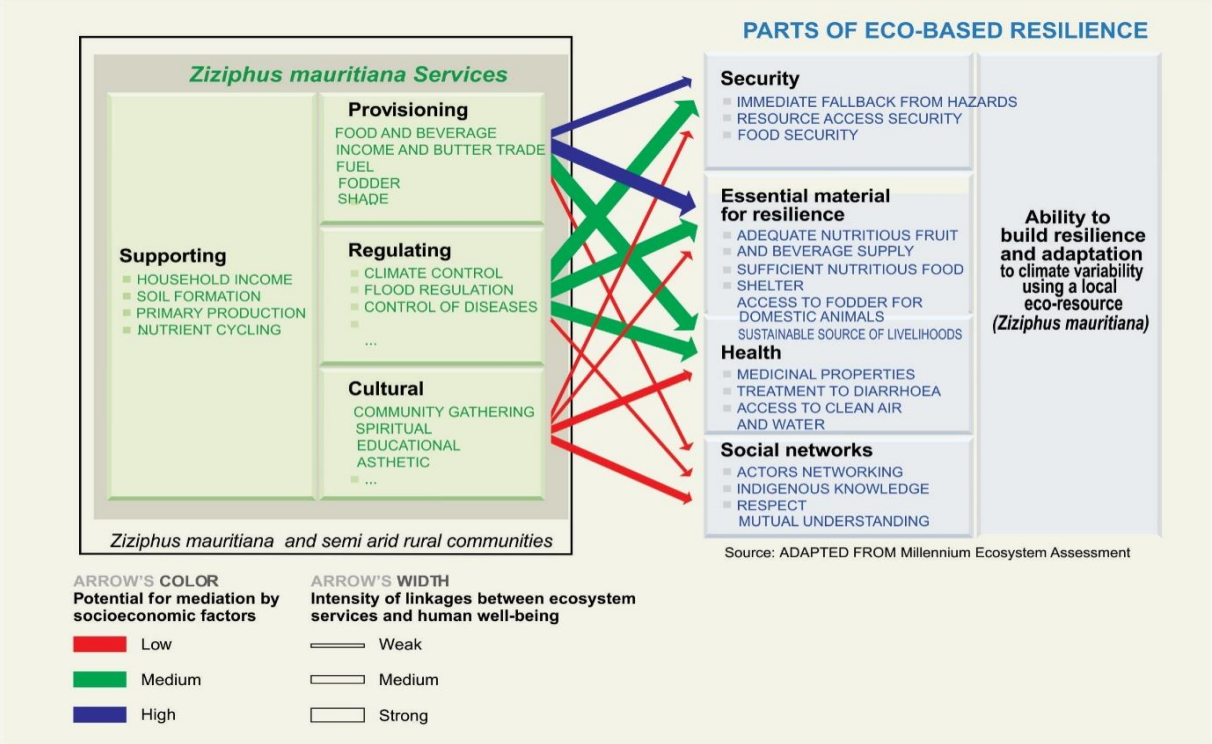


Figure 2. 1: Eco-based source of resilience and adaptation

Although sub-SaharanAfrica (SSA) has a wide diversity of natural resources, food and nutritional insecurity are prevalently high and it has the highest number of poor people (FAO, 2017; Shetty, 2015). It is estimated for example, that about 48% of the people in SSA live in absolute poverty, while an estimated 52% of women and children go to bed without basic needs on a daily basis (Shetty, 2015; Shumsky *et al.*, 2014). While these statistics are alarming, it is anticipated that they will continue to escalate due to a number of challenges such as the rise in population growth, deteriorations in national economics, weak and inefficient institutions and polices as well as changes in climate conditions and environmental degradation (Simatele & Simatele, 2014). Changes in climate conditions, for example, have become more noticeable in recent years and have manifested through increased seasonal variability in the form of increased flood and drought episodes (Fresco & Timm, 2016). These extreme weather conditions have had devastating impacts not only on socio-economic processes, but on the natural environment and ecosystems which provide a diversity of services for the wellbeing of communities (Gallopin, 2006). The El Niño induced drought that occurred during the 2014/15 rainy season across the southern region of Africa for example, subjected an estimated 30 million people to widespread food insecurity due to reduced crop production and yield (Manyanye, 2015). It is further projected that these changes in climate conditions will continue to result in noticeableimpacts on agricultural productivity across all the semi-arid zones especially in those communities where agricultural development and food production are rainfall dependent (IPCC, 2013). While the impacts of climate change will be felt in different ways and across the whole spectrum of the poor rural communities, the most vulnerable will be women, children and the elderly who in most cases lack any form of assets and production capital (FAO, 2013; ISDR, 2005; UNISDR, 2007; UNISDR, 2009a). Wood (2003), argues that climate-related phenomena will be felt greatly by the poor and the effect will be in a variety of ways among which include; increased starvation,

loss of physical infrastructure such as roads and houses and increased poor health. Furthermore, Ensor & Berger (2009), note that within the developing countries, the poor will be the most affected by climate change because they often engage and are involved in activities which are more sensitive to any changes in climate variability and have fewer resources with which to respond to shocks and build their adaptive capacity and resilience.

Several studies posit that the vulnerability of sub-Saharan African countries to the effects of climate change are not due to their geographical location or their very status of being poor countries, but rather their greater dependency on stable environmental conditions and climate-sensitive sectors (Adger *et al.*, 2009; Ebhuoma & Simatele, 2017; IPCC, 2007; Moser & Satterthwaite, 2008). The existence of a limited financial resource base, deficiencies in social protection policies and programmes, poor infrastructure, weak institutional frameworks and increased deteriorations in economic growth have combined in accentuating the impacts of climate change (Vedeld *et al.*, 2016). There is now evidence suggesting that children who are under the age of two (2) will suffer throughout their lives when weather induced famine hits, as this development often leads to poor aspirations and lower school achievement, inferior health and lower earning (see Alderman *et al.,* 2006).

The effects of climate change could also have significant indirect effects by forcing the poor, especially those in rural spaces into adopting coping strategies which would essentially undermine their ability to improve their livelihoods in the long-term (Sokona & Denton, 2001; Wood, 2003). This observation is also in Serdeczny *et al.,* (2017), who are of the view that climate change induced impacts and effects can force people to engage in risk-averse, low return activities, or worse still, asset depleting actions such as selling off productive assets, pulling children out of school, taking out high-interest loans, limiting food consumption or begging. Under such conditions, Moser (2014) argues that it becomes difficult for the poor to adequately respond to the challenges of climate change as vulnerability in one aspect can trigger the knock-on effect in other areas. This observation is eloquently discussed by (Moser *et al.*, 2010) who articulates that the adaptation of one asset often tends to affect other assets that are highly interrelated and that the erosion in one can also affect the other assets.

In view of the actual and projected impacts of climate change on socio-economic and ecological systems in the developing world, a number of scholars have argued for a search for avenues through which to facilitate the adaptive capacity and resilience of the poor see (Adger *et al.,* 2009; Ebhuoma & Simatele, 2017; Moser, 2014). There have been calls to seek a wider conceptualization of adaptation that promotes the facilitation of more affordable, equitable and gender sensitive systems of building household and community resilience. This argument is borne out of the premise that the poor are not passive actors as often portrayed in scholarly work butare actively involved in carving their own adaptation using different asset portfolios available to them (Simatele & Simatele, 2014). Rural communities, like their urban counterparts, use a myriad of assets to meet their livelihood and dietary requirements (Moser, 2008).

Ellis and Allison (2004), for example, argue that different asset portfolios and their combination enable rural populations to draw a diversity of natural resources which contribute to their livelihoods and dietary requirements, as wellas build their adaptive capacity and resilience against the impacts of both internal and external stresses. However, Cheru (2002) is of the view that the

extent, to which the rural poor can have access and the right to use natural resources in a comprehensive manner, is highly influenced and determined by the nature of existing institutional and policy frameworks. Echoing this observation, Musavengane & Simatele (2017) argue that a key precondition for achieving a successful and sustainable rural based natural resource use by rural communities is the presence of a strong and effective "enabling state" which some analysts refer to as a 'developmental state' with the capacity to respond effectively to the interests and demands of rural poor people. These arguments are further supported by Uberhuaga *et al.*, (2012)who state that it is important to understand the critical role that institutions and the policy framework play in determining the adaptive capacity and level to which individuals and households can access different resources and withstand the impacts of climate change induced environmental change (see Adger *et al.,* 2009; Frederik *et al.,* 2011; IPCC, 2013; Moser & Satterthwaite, 2008).

From the above observations, it would not be an exaggeration to say that any meaningful and effective adaptation to climate variability and environmental change is the result of a combination of household or community-based effort and the adoption and implementation of the right and appropriate institutional and policy strategies by the state and their cooperating agencies. Chambers & Conway (1991) for example, postulate that while the African state has been part of the problem, it would be an error to underestimate its critical role in any effective rural development strategy. He observes that the crucial challenge is how to dismantle the "disabling state" and replace it with a state, which is not only protector and supporter, but also enabler and liberator of the poor (Chambers & Conway, 1991). This argument questions the effectiveness of communities and the state operating in silos and advocates for a scenario of increased partnerships among different stakeholders in order to understand how different components combine to bring about one or a series of outputs. It also challenges our understanding of contemporary survival processes and systems that rural poor communities, that are highly dependent on natural resources such as wild fruits and vegetable, deploy in their quest to adapt to climate variability and improve their wellbeing (Shumsky *et al.*, 2014; Thondhlana & Shackleton, 2015).

In a bid to comprehensively understand the complex interactions and relationship of rural communities and their natural environment and how they build resilience against internal and external stressors, a number of scholars have advocated for the use of the Actor Network Theory (ANT) in the analysis of this relationship (Dwiartama& Rosin, 2014). Shumsky *et al.,* (2014), for example, argues that because of the significance of natural resources to rural communities, it is vital that there is a good understanding of how social-ecological systems interact to produce certain desired livelihood outcomes. Furthermore, development analysts such as Manyanye (2015), Thondhlana *et al.,* (2015) and Elizabeth *et al.,* (2014) are of the view that this understanding is essential to enlighten the management of natural resources and to promote economic growth and national development, which are key components for sustainable community transformation. Thus, Dwiartama and Rosin (2014) argue that ANT presents an opportunity in addressing the challenges caused by climate variability by exploring how communities build their adaptive capacity and resilience against climate variability using different asset portfolios such as natural resources, social, civic and political capital (Ginieniewicz, 2009). Research traditions have addressed natural resource use and management basing on theories

such as the common property, political ecology, social learning, and resilience (Simatele & Simatele, 2014). However, these paradigms have at times failed to account for the complexities embedded in the use of natural resources (Kinnear, *et al.,* 2013). Moreover, most of the existing research on resilience has tended to confine its attention to social processes, while neglecting the interactions in the nexus of "the social, ecology and political", aspects which if properly combined and effectively managed, can trigger more sustainable systems of adaptation to climate variability and change.

ANT lies within the broader discipline of sociological science and works towards creating an understanding of the interactions and connections between human and non-human entities. Its key argument revolves around the assumption that the connections and interactions between human and non-human tend to lead to the creation of new entities that do not necessarily embody the sum of characteristics of the original constituent entities (Law & Hassard, 1999). An example here could be the combination of the "man and the gun' to form a new entity of a gunman but both man and gun exist as separate entities, however can be combined to create a powerful new entity called "gunman", which can be used to achieve a specific task. Thus, ANT as an analytical framework seeks to identify different processes, connectionsand/or conditions of networks and how they produce certain outcomes (Ernstson, 2008). The theory attempts to understand how effects of networks are produced and reproduced, thus giving distinctive theoretical tools to understanding complex relationships and connections (Law, 1992). By studying and understanding how these networks operate and function in time and over space, unique opportunities can be rendered in the identification of appropriate and effective formulation of policy and intervention entry points that are well suited to the needs of communities (Czarniawska & Hernes, 2005). In the context of this chapter, the focus is on understanding how community (social asset) access to *Zm* (a natural asset), and institutional and policy framework (civic and social assets) in rural Zimbabwe can contribute to the building of the adaptive capacity and resilience of rural populations in the face of increased drought and flood episodes.

2.2 The Sustainable Livelihoods framework

The SustainableLivelihood Framework by the United Kingdom (UK)'s Department for International Development (DFID) (2000) presents some of the measures which can be used by communities to adapt to climate variability in Muzarabani.. In the context of this study, the aim is to enhance effective roles played by *Ziziphus mauritiana* to the Muzarabani community. The framework bundles different sectors as complementary adaptation options in rural communities. The framework is also dynamic as it overlaps in time and space, addressing complex interplay amongst factors. Although widely adopted by NGOs, the sustainable livelihoods framework has received criticisms (Ncube-Phiri *et al.*, 2014). These include its elevated skills and resource requirements. In terms of implementation, little attention is given at times to the complex social ecological consequences of adaptive livelihood (Musarurwa & Lunga, 2012).

2.3 Adaptive capacity and resilience approaches

According to IPCC (2013), adaptive capacity refers to the adjustment capability of a system to climate variability, to reduce potential harm, to benefit opportunities or to manage the

consequences. Adaptive capacity is a term commonly used interchangeably with 'resilience'. A community's capacity to adapt and survive shocks is based on its resilience (Folke, 2006). Resilience varies from one geographical area to another, one community to another. It is determined by the community's assets, and the services provided by the government and other institutions(Bandara & Cai, 2014; Elizabeth *et al.,* 2014; Tompkins & Adger, 2004). Assets embrace a lot of things and amongst the list are: physical and financial capital; knowledge and labour in a household; social relations and access to natural resources. Adaptive capacity strategies for societies are shifting from those based on technological developments, engineering structures with economic diversification to strategies based on natural resources(Elizabeth *et al.,* 2014; Manyanye, 2015; Tompkins & Adger, 2004). This confirmation is based on the known association between human livelihoods and ecosystems (Enete & Amusa, 2010; Kinnear *et al.,* 2013). Ecosystems provide an array of services that play an important role in preserving societies. These embrace provisioning services, such as cultural services, food, fibre, fuel, and regulating services (Bharucha *et al*., 2017). Indigenous fruit trees like the *Ziziphus mauritiana* play an important role in the adaptive capacities of many rural communities affected by extreme weather conditions. Although the comprehensive linkages between indigenous fruits and climate variability are not always well understood, it is widely recognised that they have a role to play in environmental change (Elizabeth *et al.,* 2014; Tompkins & Adger, 2004).

Every human being possesses the distinguishable capacity to adapt to extreme weather conditions even though they might be vulnerable (IPCC, 2014; Quandt *et al.,* 2017). In most cases the poor rely directly on ecosystem services, especially in areas prone to extreme weather conditions. According to the World Resources Institute (WRI) (2008), at least three quarters of those living on US$2 or less per day in the world, rely on the natural resources at their disposal as part of their livelihoods. In Africa, more than 70 per cent of the population depends on rain fed agriculture, and the rest depends on forest products, fishing, and hunting (Nyanga *et al.,* 2012). It is against this backdrop that adaptation and mitigation strategies improve resilience and continually provide ecological services and goods that can be vital for poor communities (Saka & Msonthi, 1994; Thondhlana *et al.,* 2012; Tompkins & Adger, 2004). Low adaptive capacity by poor communities makes them vulnerable to the shocks of climate change (Enete & Amusa, 2010; Manyanye, 2015). Communities can operate within a vulnerable environment shaped by different factors and can draw on different capital, such as natural capital shown in Figure 2.2. The diagram shows the interrelationship between the different components with the aid of arrows; the ultimate goal is achieving positive livelihoods.

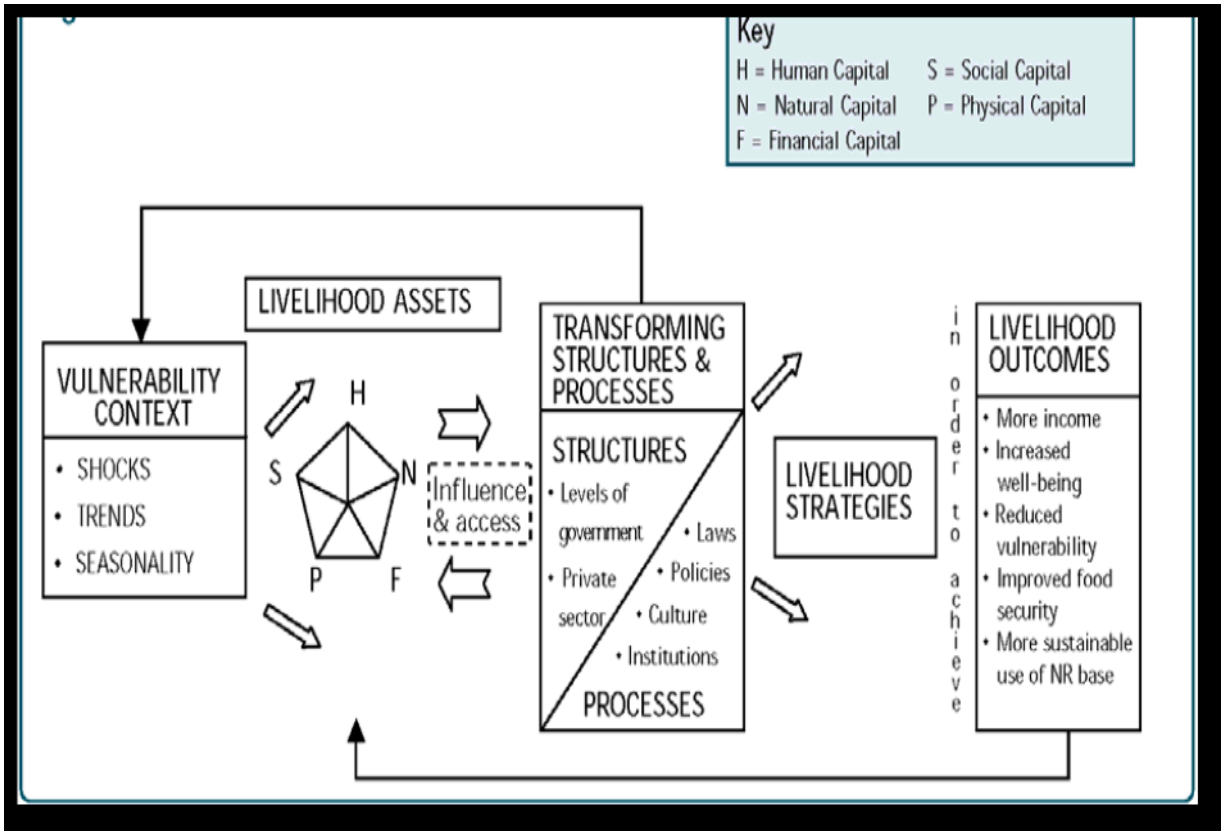


Figure 2. 2: Sustainable Livelihoods Framework

Source: DFID, 2000

2.4 Actor Network Theory (ANT), adaptive capacity and resilience

The literature reviewed points to the fact that few studies have adequately addressed the complex roles of both nature and society in promoting a better understanding of the concept of adaptive capacity and resilience (Adger *et al.,* 2009; Allison & Hobbs , 2004; Olsson*et al.,* 2004; Soemarwoto, 2007; Walker *et al*., 2004; Wessing, 1988). ANT highlights how human and non-human agencies (actors) stimulate the process, guide and edge the insight and action of human users. ANT concludes with general insights gained, useful in understanding current dynamic social and ecological complexities in alternative adaptive capacity and resilience strategies in developing countries. Treating human and non-human actors as separate is contrary to ANT's principle of symmetry (Ernstson, 2008). In context, Latour (2005) gives equal status to these two actors, considered inter-connected agencies in order to achieve certain goals. For example, when considering the effective utilisation of natural resources (e.g., *Ziziphus mauritiana*) by women in a semi-arid region, one must consider the two actors (humans and the natural resources) without separating them. Since its conception, ANT has continued to extended its efficacy as a tool for studying institutions,tourism, geography, innovation power, and education (Czarniawska& Hernes, 2005; Dwiartama & Rosin, 2014; Fenwick & Edwards, 2010; Miettinen *et al.*, 2012; Murdoch, 2001; Neisser, 2014). ANT highlights how non-human and human agencies (e.g. fruit trees, such as *Ziziphus Mauritiana*) shape, guide and limit the perceptions and behaviour of human actants.

2.4.1 **Power**

Accordingly an actor does not continue to exist merely as an entity, but rather as a coalition of heterogeneous essentials that arrange into a network (Latour, 2005). Thus, a network is an assemblage of actors and their relations with other actors. Within such a network, it is possible to analyse power relations. The stability or volatility of the network becomes comprehensive at the same moment that the essentials of the network transform (Latour, 2005; Law, 1992; Neisser, 2014). The characteristics of a network include the subjective aspect of "perspective" because the 'actors' in a network are not merely entities unto themselves but are a more complicated compilation of multiple factors (e.g. lesser actors). *Ziziphus mauritiana*, for example, may be viewed as a functioning adaptive capacity and resilienceactor that plays a role in a larger network in which it creates associations with and links to other mitigation actors, such as non-governmental actors. The point is that no actor is more important than the other (Muhonda *et al.,* 2014). ANT is a versatile tool that can be used to meet the research goals according to the preferred perspective of the researcher (Latour, 2005).

Governmental or non-governmental organisations (NGOs) play a critical role in directing interest in mitigating the effects of hazard events (IPCC, 2014; Rovins, 2009), caused by both natural and anthropogenic factors linked to the purpose of serving, protecting and helping the affected regain a sense of normalcy. Preliminary hazard response efforts tend to focus on food distribution, housing and medical aid, while longer-term assistance and the required social services to sustain assistance, are ill-conceived. Governments, primarily for political reasons, often disrupt the smooth running of non-governmental organisations in needy areas (Gukurume *et al*., 2010). This frequently occurs as a consequence of hastily conceived responses to previous hazard events; generally, in the stature of policies to drive preparedness along by means of mitigation. Various instances overlap and imprecise roles result in conflicts at the expense of the recipients. Consequently, within the framework of livelihoods, adaptation and resilienceis a complexity of interactions between individuals, groups and communities, and government and non-government organisations, each with potentially different concerns and agendas.

2.4.2 **Scale**

Scale is a geographical term used to determine, measure and calculate the distance between two points on land (or on a map) in a specific metric. Scale normally represents a distance on a map in relation to the real location on earth. Scale is an idea deeply rooted in most geographic thinking as a simple term which refers to proximity or a distance (Callon & Latour, 1981). ANT refers to scale as networks or associations, which can be either geographical space or social space (Czarniawska & Hernes, 2005). Micro or macro scale: the notion of network allows us to dissolve the smaller-larger-distinction that has plagued social theory from its inception. Individuals, groups, nations or regions are replaced by connections. A network is never bigger than another; it is simply longer or more intensely connected. Networks ensure the success or failure of a system, it is indeed the properties of these networks that make the difference between the possible and the impossible and these are called prescriptions (Law, 1992). It is, therefore, important for researchers to explore how networks change over time. Adaptive capacity and resilience approaches in most countries are more inclined or often relegated to the realm of politics and policy-makers and as a result communities not usually consulted in

decision making (Lindell *et al.*, 2006; Manyanye, 2015). Adaptive capacity resilience thinking, political leaders, hence have put options forward in policy or its development has been surrounded by policy studies (Mileti, 1999; Neisser, 2014). This seemingly "backward" planning and implementation approach has been referred to as a "top- down" approach, rather than the needed ANT notion of scale (Gwimbi, 2004; Gukurume *et al.,* 2010).The typical approach has been for actors to focus on resilience and livelihoods, planned around areas noted on maps to be natural hazard prone. However, such typical approaches are insufficient as they do not include preparation for hazards through a web of complex connections with different actors, which includes educating the local populace and other actors about potential hazards and effective mitigation techniques (Rovins, 2009).

Actor Network Theory notion is ideally different from the common failed social theory which calls for a top down or up bottom approach. In contrast, it does not attach an assumed relation, be it up bottom or the opposite. The absence of a prior scale makes it easy to follow the changes in the scales. Actors are the determinants of the number, the type and topography of connections(Gibran, 2013). The ANT concept allows us to better understand the complex elements of society that include its space which might be vertical, macro scale, hierarchy, their overall characteristics, their wholeness and how they are made. The idea of networks permits us to consider a well-connected global entity, which remains nonetheless endlessly local. When a given element becomes strategic, instead of opposing, it creates a need to follow its connections and establish how it commands or loses its importance. Influenced by post-structuralism, ANT is essentially interactive engaging a sense of possession over space which is not generalisation, but actual realities moulded by the deliberate actions of specific actors. ANT ownership enables a deeper investigation of how individuals express their intervention in space with particular regard tolivelihood, adaptation and resilience.

2.4.3 **Network**

According to Latour (2005), an 'actor-network' is not an 'object', but rather "collective translations" and should be viewed as a living, changing entity or a group of inter-connected entities. Actors are individual entities, actor-networks are groups of actorsnetworks of heterogeneous entities linked with one another through different relationships, and whose resistance has been overcome (Law, 2007). In a network there is a mutual sense of belonging between actors and networks, as networks constitute actors. Actors cannot perform without networks and the reverse is also true. Policies and non-governmental organisations cannot provide food aid without networks to fulfil their mission. In the case of *Ziziphus mauritiana*, adaptive capacity andresilience strategies are conceptual spaces underpinned by actor-networking in which non-human actors, such as the government and non-governmental organisations, are part of the existing network and help in translation which needs to be followed. Callon (2005), states that it is difficult to recognise the range of effects or impacts of non-human actants as they appear in a number of different ways, for example, natural resources like *Ziziphus mauritiana,* intangible government policies, and human-originated food aid packages. Latour (2005), states that in order to understand the complexities at the social and technological levels, one must first understand the roles, power and interactions of both human and non-human actants in a specific crisis situation, in a specific locality, then conceive a solution based on the understanding of

these locality-specific complexities and actants (Callon, 1986; Latour, 2005; Dwiartama & Rosin, 2014).

According to Neisser (2014), ANT presents a basic analytical tool, primarily because it has clear ways of exploring the "process of translation" presented by Callon (1986) as: firstly problematisation, which refers to the identification of the problem and possible solutions based on observable facts; secondly interessement implies the support that actants will have towards the identified problem; thirdly enrollment, refers to activities that actants perform to solve the identified problems and fourthly mobilisation, the last moment of translation, which refers to the stabilisation in wider or new networks, in which charts, graphs and maps represent the associations and networks of actors as reality. Networks should have nodes and lines; it can be the joining of people, groups, and systems of alliances, and actor-networks become actors (Linde *et al.*, 2003). Some social scientists refer to the stability of networks as the "Black Box". This means when interactions are established, they are durable, and remain unquestionable. However, it ought to be mentioned that to have a stable box during the process of translation moments, resistance, negotiation, and realignment need to be considered (Latour, 2005; Dwiartama & Rosin, 2014). It is in the interest of this research to understand the four moments of translation and how they relate to the field of climate variabilty, livelihood, adaptation and resilience under study. A network is never bigger than another; it is simply longer or more intensely connected. Networks ensure the success or failure of a system; it is indeed the properties of these networks that will make the difference between the possible and the impossible and these are called prescriptions (Law, 1999). It is, therefore, important for researchers to explore how networks are formed, who created them, who has power and what the network does as well as who upholds the links and the dynamics over time.

2.4.4 **Actants**

Actor Network Theory uses the term "actant" or actor in reference to non-human or human life, which are all treated equally when assigned to some social function (Law, 1992; Latour, 2005; Dwiartama & Rosin, 2014). The primary interest of ANT in practical application is considering the associations or links that may be recognised among various actants for specific purposes, such as policy formulation or research, and the identities, roles, and interactions of actants (Latour, 2005; Law,2007). Actors come in different forms, though they should be treated equally by the focal actor who might persuade other actors. Amongst them are those Latour (2005) call: (1) actors who are not identified by the objectives of the network, but are enrolled once in agreement in terms of goals explained by the controlling actor; (2) actors who might be resistant to the roles they are supposed to play; (3) actors who are disruptive and thus act against the interests of the network; and (4) actors that exercise control on behalf of the controlling actor. It must be noted that actors, are not actors of a specific network if they do not have an influence in the process of control of a particular network. As a result, the researcher is confronted with "generalisedlivelihood, adaptation and resilience strategies" that do not take into account the varying nature of actants, particularly non-human actants, in specific situations. This calls for more inquiry into the subject. It is imperative to note that there is no reason, as suggested by other critiques, to focus on the identification of what non-humans are (Latour, 2005; Law, 1992). ANT advocates that the focus should be on what things the actors contribute to society.

ANT theory rejects the notion of human agency (or human intention) as the prime influence onlivelihood, adaptation and resilience, and recognises all relevant factors (e.g. flora and fauna, water, geologic factors and climate. González (2013), notes that the term "actors' in the ANT context is different from common usage of the term in which actors are defined as and understood to be single entities. Actor Network Theory creates value to any actor since power is bestowed on it. The power extends to any actor (actant) that may influence a situation (Latour, 2005; González, 2013). In conclusion, ANT gives insights gained which will be of use in the understanding of current dynamic social and ecological complexities in alternative adaptive capacity and resilience strategies in developingcountries.

2.4.5 **Criticism of Actor Network Theory**

Critics question the use of human and non-human actors on an equal footing based on social issues associated with daily routines (Calas & Smircich, 1998; Callon & Latour, 1992; Whittle & Spicer, 2008). ANT does not recognise social structures in a traditional sense, but rather places emphasis on the association between entities, which are not recognisable as social in the ordinary manner. There are notable differences in the theory of social network structures, which differ from ANT human components that interact with non-human components to determine power relations amongst actors (Whittle & Spicer, 2008).

Actor Network Theory is challenged in its assignment of non-human actors as important facilitators in different processes (Whittle& Spicer, 2008). However, advancement in technology has supported proponents of ANT in some way, since technology plays an important role in many daily activities and in turn shapes them (Whittle & Spicer, 2008). The question of power has also been probed within a network; however, Latour (1997)believes that power determines the strengths of individuals that might not connect to the ANT. The theory has also been criticised for being "everything", since one cannot tell whether it is a theory or an approach (Calas & Smircich, 1998; Czarniawska, B., and Hernes, 2005; Whittle & Spicer, 2008). The critique is based on the idea that it is too descriptive and fails to deliver concrete suggestions. It has been suggested that ANT should be used with other approaches (Law, 1999). Latour (1997), one of ANT's proponents, stated that it is not and was never intended to be a 'theory', but rather a tool with which people and ideas can be connected or assembled. Despite all the criticism, ANT is recognised as a powerful tool, and has been used by many researchers (Law, 1992; Latour, 1997; Czarniawska & Hernes, 2005).

Ziziphus mauritiana produce edible fruits which are green-yellow when ripe and eventually turn brownish when dried (see Plate 2.1).

2.5 *Ziziphus mauritiana* (or '*Masawu*')



Plate 2. 2: Fresh *Ziziphus mauritiana* (or "*Masawu*")

They are part of the Savannah forest patterns that forge mutually valuable associations, creating a rural ecosystem that is more than the parts of its sum. *Ziziphus mauritiana* is a small tree with a wide geographical spread and exhibits a combination of drought and floods tolerance. Due to a high degree of climatic adaptability, *Ziziphus mauritiana* is an important multipurpose fruit tree of arid and semi-arid spaces and plays a major role in preventing soil erosion and desertification (Lal & Dhaka, 2007; Pasternak *et al.,* 2016). It grows in most semi-arid areas of Sub Saharan Africa where annual rainfall ranges from 200-1, 200 mm (Yousif *et al.,* 2015). The *Ziziphus mauritiana* species are also common to the drier regions of South and Southeast Asia (Yousif *et al.,* 2015) . *Ziziphus mauritiana* is tolerant of drought, water-logging, salinity, a wide range of soil pH values and temperature ranges (Grice, 1997; Saran *et al.,* 2006). *Ziziphus mauritiana* resembles high levels of plasticity in response to water deficits. It's extensive roots and ability to shed leaves under drought conditions constitute its physiological attributes of success in extremely hot and semi-arid spaces (Grice, 1997; Tougiani *et al.,* 2017) .

In Muzarabani, *Ziziphus mauritiana,* an indigenous fruit tree which provides important sustenance during periods of hazard, exemplifies a non-human actor in ANT (Neisser 2014). *Ziziphus mauritiana* provides fruits that can be used as a source of food, fuel, medicines and possibly other as yet unknown products. Human activities, however, threaten the sustainability of this rich natural resource (Saka *et al.,* 2007; Tembo *et al.,* 2008; Shackleton, 2015). In the same context *Ziziphus mauritiana* offer ecological, economic and social roles that include; the provision of employment, acting as a food safety net for communities (Thondhlana & Shackleton, 2015) in Muzarabani; even in other times of hardship, for example, high unemployment and general impoverishment in the community. According to Bharucha (2017), the natural environment provides a vast array of indispensable resources and services to human beings. *Ziziphus mauritiana*

is eaten fresh or dry. It can be used as an ingredient for fruit drinks, non-alcoholic and alcoholic beverages. *Ziziphus mauritiana* is a cheap source of vitamins C derived from wild fruits, it is rich in sugar and provides reliable animal dietary sources for domestic local livestock (Saka *et al.*, 2007; Tembo *et al.*, 2008). It presents a food safety net when the region experiences weather catastrophes such as floods (Shackleton & Gumbo 2010;Chazovachii *et al.*, 2012). Despite its importance, *Ziziphus mauritiana* has received little or no attention, even at policy level, when dealing with issues in fragile environments like Dande. *Ziziphus mauritiana*, locally known as *Musawu*, provides an opportunity for an Actor Network analysis, which helps to explain the complex mutual association of non-human and human actors in the complexlivelihood, adaptation and resilience discourse on Muzarabani (Neisser, 2014).

The rural Muzarabani community relies heavily on *Ziziphus mauritiana*, which arguably has origins in India and is currently naturalised in many tropical regions (Mukhtar *et al.*, 2004). Countries where *Ziziphus mauritiana* is grown naturally and domestically include Russia, the United States of America, China and countries in the Middle East. *Ziziphus mauritiana* is known in India as *jujube* or desert apple. It is a tropical fruit, normally cultivated in marginal lands. Small and large plantations have been observed in Afghanistan (Mukhtar *et al.,* 2004). The absence of these in Zimbabwe and other sub-Saharan African countries remains a puzzle. Muzarabani, like most rural areas in semi-arid regions south of the Sahara, is characterised by complex and intricate social, ecological and political webs between and amongst different actors. This makes addressing adaptive capacity and resiliencestrategies a daunting task. Primary reasons for adaptive capacity and resiliencestrategy failures are multifaceted and include: political interference, non-existent institutions, weak policies on adaptive capacity and resilienceapproaches, lack of local support, and insufficient manpower, monitoring and evaluation (Muzeza, 2013). Concurrently, demonstrated success in Muzarabani could provide viable mitigation planning information to other regions and countries. The analyses of the value attached to *Ziziphus mauritiana* by different actors, could be explained by the commodity value chain approach.

2.6 Commodity chains

It is imperative to follow the identified eco-resource through literature to deduce meaning that would benefit the poor in semi-arid regions. The commodity chain approach has been used extensively in social science scholarly work (Bair, 2008; Chagomoka, *et al.*, 2014; Chibarabada *et al.*, 2017). The concept 'commodity chain' in this paper refers to the analytical overview that defines specific arrangements among actors that confirm the flow of *Ziziphus mauritiana* from the input resources used to the end user or consumer. It is well documented that placing commodities at the hub of the narrative, builds the approach's muscle, not only in tracing the material flow of commodities, but following the social relations flow. The commodity chain is an important tool used to study, identify actors, spaces, and relations. The chain also identifies and explains sites of production, barter and use. In addition, the commodity chain goes beyond the nodes and institutions of specified markets; commodity chain analysis recognises points of regulation and power amongst various actors (Chagomoka *et al.,* 2014; Saguin, 2014; Chibarabada *et al.,* 2017).

Concepts that are related but theoretically different are: *filiere*, Global Commodity Chain (GCC) and Global Production Network (GPN). The identified concepts all give explanations of the

relationships, business and conduct involved when commodities move. Intellectual bias, themes and methods are the origins of concepts that constitute the value chain. Very few scholars discuss the *filiere*, which is entrenched in the societal analysis of the home production-use dynamics of agro-ecological commodities(Ribot, 1998; Bernstein & Campling, 2006). *Filiere* is argued to be the most traditional concept to explain value chain. Scholars do not mention or use the concept *filiere*, instead they use the following terms: GCC and GPN (Bair, 2008; Chagomoka *et al.*, 2014; Chibarabada *et al.,* 2017).

GPN, unlike the traditional concept *filiere,* are more concerned with global chains or associations that are entangled in production, generally in the framework of export or manufacturing industries (Bair, 2008; Saguin, 2014). The *filiere* examine the flow of agro-ecological commodities within a chronological context. Though regarded as traditional, it is useful and compatible with current concepts (Ribot, 1998). *Filiere* can be supported with commitment from current concepts and methodologies namely GCC and GPN.

Literature states that commodity chain concepts in discourse within a given approach offer likely benefits. According to Gereffi & Christian (2010), the GCC emphasises input-output framing by the actors involved. GCC complements trade amongst agro-ecological actors. Focus is on determining material flows in different spaces (Gereffi & Christian, 2010). GCC, however, goes further than mere accounting by collectively embedding the flows of material spacesand focusing on power relations within the chain, a primary concern oflivelihood, adaptation and resilience priorities (Grivins *et al.*, 2016). The preceding demands of GCC imply that commodity chains permit scholars to perceive the fixing of flows in terms of daily social-ecological relations spatially and temporarily (Shackleton *et al.*, 2015). Commodity chain actors, through every day practices and relations, standardise the fixing of these flows. The study in question, through ecological, economic links and social associations amongst producers, labourers, traders, middlemen or intermediary, and other actors, needs to map out the materials and the fixing of these flows. In context, the change in these flows and chain should be analysed within the broader context of the fruit (*Ziziphus mauritiana)* production (Hichaambwa & Tschirley, 2006). In the social science and economics spectrum, the GPN approach is widely used. Much use has been made in developmental discourse and identification of possible upgrading points to augment the marginal actors' benefits in the chain (Gereffi *et al.,*2005). The study puts into consideration the strengths of the GCC based methodology in formative distributional concerns within the chain, predominantly those enshrined in inter-actor linkages (Grivins, 2016). The idea of linear chain thinking has been criticised by the GPN approach for its limitations. The complexities of inter-network linkages within the value chains, calls for a different lens as proposed by the GPN (Chibarabada *et al.,* 2017).

Supporting this argument, this literature review is compelled to hold the commodity chain concept mainly because of its global plea, particularly in climate variability and agro-ecological studies (Grivins *et al.,* 2016). Various scholars, rally behind the GPN's appeal to give all actors equal standing in the chain analysis. It is well documented that the GCC approach has honoured horizontal firm relations and economic actors GPNs have advocated for the enclosure of non-firm and non-economic actors. The approach calls for the inclusion of vertical relations on intra-firm dynamics. The former is persistent on the instruction to position commodity chains (Grivins *et al.,* 2016; Chibarabada *et al.,* 2017).In contrast, the latter places importance on labour

within such relations and chains (Chagomoka *et al.,* 2014). The holistic approach to commodity systems takes into account the whole process of commodity relationships is a complex task indeed. GPN needs another approach to supplement its efforts to enhance the understanding of value chains in stressed environments. The ANT approach, discussed in this article, seems the way forward in Muzarabani where the *Ziziphus mauritiana* value chain is examined.

The social ecological orientations of economic activities have influenced the GCC and GPN frameworks (Peck, 2005; Grivins *et al.*,2016). The actors' explanation in this article mention equity, responsibilities and other social associations fit within this practice. The aim of this review is to give a background into the enquiry of actors, access, control and interlinkages. The ANT framework (Murdoch *et al.*, 2000), is of use here as a supplement, even if it is criticised for not addressing the structural sources of power, as put forward by Grivins *et al.,* (2016) in a commodity chain approach. Studies grounded on ANT have the potential to extend our understanding of actors and who or what is tangled in the creation of commodity networks. Shared is the commitment to consider commodity associations as encompassing hybrid, natural and socio-cultural ecosphere or worlds (Fink & Weyer, 2014).

However, Grivins *et al.,* (2016) as well as) Fink & Weyer (2014) lean towards restricting their analyses to particular networks, engaged in how the action of actants/actors materialise because of their interactive roles within these linkages, and how these protagonists establish and alter the linkage under study. These scholarships do not reflect how contestants in commodity linkages are involved in other classes of social interactions, nor do they mirror the conducts in which their involvement is formed by wider cultural accounts and associations of power(Manyanye, 2015).Therefore, such studies also fail to capture the various, positioned sets of eco-cultural associations through which commodity chains take form for the benefit of the poor communities in natural hazard prone areas. The ability to access or receive benefit from flows of *Ziziphus mauritiana*, however, presents a uniting concept that explains an array of complex relations amongst actors, both human and non-human.

2.7 Summary

This chapter exploreshow cushion capacity and resilience can be evaluated for livelihoods prone to climate variability. It used the case of Actor Network Theory in the frame of an eco-resource (*Ziziphus mauritiana*), to analyse how poor rural semi-arid farmer practices can add to building buffer capability for dealing with the adverse impact/s of climate variability in political, social, ecological, economic, and other scopes. The analysis of *Ziziphus mauritiana* use and interactions practices related to resilience capacity in the study area include; *Ziziphus mauritiana* protection, sustainable use, marketing or Commodity Chain Analysis, and Sustainable Livelihood Frameworks understanding. By establishing how to embody and analyse, resilience or buffer capacity, this chapter contributes to the identification of gaps between extending the means through which the resilience capacity can be made, operating on an empirical inquiry and an analysis of the contribution of local eco-resources to livelihoods.

Thematically, it demonstrates that the embracing of ANT and other theories like CCA and SLF can enhance the understanding of improved resilience capacity to climate risks, such as floods, water scarcity, and droughts. However, trade-offs may arise out of increasing the buffer capacity

of individual farmers and that of the rural economy as labour-saving on farms, translates to reduced job availability in the rural economy. The chapter did not cover all eco-resources or wild fruits utilised in semi-arid spaces, the single identified *Ziziphus mauritiana* as a resilience capacity profiles have the potential to be advanced into a policy support system for government and non-governmental actors to enable them to speedily gain insights of rural poor's practices and development options. The chapter suggests the enrolment of diverse actors in the adoption of the oftenneglected eco-based resilient approach from rural spaces. This can promote the use of good practices and expert assessments that can complement rural farmer's ecological assessments and necessity to be taken aboard in future studies.

CHAPTER 3

METHODOLOGICAL CONSIDERATIONS

3.0 Introduction

This chapter presents the following: philosophical positionality, description of the study area, research design, sampling, data collection methods and data analysis tools as shown in the flow chart in Chapter 1 (see Figure 1.1). The previous chapter gave an outline of the literature relevant to eco-based resilience, looking at *Ziziphus mauritiana* (*Zm*) in the framework of rural resilience. In addition, Chapter 2 also examines current approaches to conceptualise climate variability and livelihoods, before outlining the main aspects of the concept, Actor-Network Theory (ANT) used in the results and discussions in Chapter 4 and 5. The primary aim of this chapter is to discuss ANT as a theoretical framework and research methodology, gathering increased considerations in social ecological science. To date, the bulk of research done on livelihoods and resilience in sub-Saharan Africa has placed great emphasis on the quantifiable contribution made by wild fruits to the economic security and dietary well-being of poor or low-income households. As a result, it fails to capture the basic interactions that help people achieve better results in their resilience and livelihood efforts. Therefore, there is a need for qualitative research. The investigative nature of qualitative research also allows the flexibility to produce new approaches and theories when existing approaches no longer fit changing circumstances (Creswell, 2007; Denzin & Lincolan, 2000). It has been submitted that although the total quantity of food grown in the wild far exceeds what is expected or grown in more drought and flood-prone areas; as a sector it remains overlooked and understudied by responsible actors that include: NGOs, local governments, and academics (Quandt *et al.*, 2017). This calls for research on the interactions, beliefs, behaviours and attitudes that accompany the use and management of local wild fruits like, *Zm,* by people living in semi-arid rural areas (Kortright & Wakefield, 2011; Quandt *et al.,* 2017).

The methodological approach and qualitative research used in this study reflects the aim of the study, which is to understand the role of *Zm* in the context of rural resilience. The approach focused on diverse actors' experiences, and explanations of why they started and are continuing to grow *Zm*. Qualitative research may be inter-disciplinary, or trans-crosscutting human, ecological and social sciences, which makes it appropriate for unearthing the social, economic and ecological behaviours, attitudes and opinions of rural people who depend on *Zm* (Denzin & Lincolan, 2000). Qualitative research representations or models of interviewing intend to understand the world from the point of view of the interviewee, to reveal the meaning of his experiences rather than projecting an edifice onto what is being studied (Flick, 2009). The first part of this chapter presents the philosophical positionality. Next to be explained, is the description of the study area, Muzarabani, found in the Northern part of Zimbabwe. Sampling procedure, data collection and data analysis are covered as the chapter introduces the ANT and Grounded Theory methodology (GT) used in this research (Strauss & Corbin, 1994). This chapter further appraises ANT as a good candidate to guide experimental studies within a wider critical paradigm, as suggested by (Latour, 2005). Finally, an evaluation of the limitations of this specific study appears at the end of the chapter.

3.1 Philosophical Positionality

This study is an ethnographic qualitative study and was underpinned by social post-structuralism philosophy. According to Neuman (2011), philosophy is the basis of scientific, social research, which can be either quantitative (positivism) or qualitative (post-positivism) based. Ritchie *et al.* (2013) acknowledge that qualitative research presents an array of ways in which data may be gathered. To fulfil the aims and objectives of this study, qualitative approaches were used which depended upon a variety of factors. Firstly, ontological considerations, which included values concerning the social nature of the surroundings, were employed during the research process (Holloway & Wheeler, 1996; Creswell, 2007; Ritchie *et al.*, 2013). Secondly, Epistemology, which entailed the natural world of knowledge amid how it could be obtained, influenced the collection of data on the role of ANT in the enhancement of resilience and natural hazards mitigation options. The third is the real field that referred to essential process and method (Creswell, 2007).

Ontological assumptions put forward that there is a reality that can be understood. In context this means; reality is independently regarded as it exists for those who view itbut is only reachable in the course of the perceptions and interpretations of individuals (Charmaz, 2014; Scotland, 2012). The researcher values the substance of different actors; human and non-human interpretations, of the issues of interactions in eco-based livelihood, adaptation and resilience approaches. In the same vein the researcher believed that, this enabled him to follow the actors and capture different types of understanding of eco-based resilience approaches and the networks that emerged from *Zm* in Muzarabani.The researcher' s understanding was that the external reality was varied and complex and it was the aim of this research to investigate how in this complex reality, tools like ANT and Commodity Chain Analysis were used to enhance the understanding of the importance of natural resources during and after natural hazard episodes. Post-structuralism is fast becoming an important philosophical perspective from which to view issues in the social sciences (Neuman, 2011). Post- structuralism proposes that comprehending the social sphere involves realization inside the world of those creating it (Denzin & Lincolan, 2000). Knowledge is produced in the course of interaction between the researcher and that which is being researched (Neuman, 2011). Consequently, it was vital to be as close as possible to study participants (Creswell, 2007) for the researcher to best understand the actor/s (e.g. *Ziziphus mauritiana* (*Zm*) and their interaction with other actors. Post-structuralism philosophy reality posits that it is precisely socially constructed and was used in this study based on the above arguments.

The study embraced a blend of qualitative methods: ANT, Commodity Chain Analysis (CCA), document analysis, and GT. The methodological difference between this particular research study and other related research studies in geography and environmental studies was the use of ANT as a method as well as a means of analysis. According to Ritzer (2004), ANT is both a theory and an applicable method or approach to analysis in a study. Human and non-human actors were considered as important in the quest for sustainable eco-based resilience approaches. This was based on translation processes summarized in the framework: (1) problematization, identification of problems and solutions; (2) interessement, follow up of defined problem by those interested; (3) enrolment, performance of actors to prescribed roles; and (4) mobilization, stabilisation and creation of new networks by identified diverse actors (Callon, 1986).

The most important input of ANT towards social theory was the reconsideration of the non-human as an actor in the social and natural structure. This research has garned great interest by the innovative ways that ANT gives for ontological philosophy explainations about hybridist and complications, and about human interactions with the non-human (Creswell, 2007). This was a geographical study characterised by complex social and ecological issues and called for a subjective reality study. *Zm* as an important unrecognised eco-resource information from the Muzarabani District in Zimbabwe was solicited and subjectively analysed using an approach which was driven by GT, ANT, and CCA. This approach was empirically oriented. The focus was rather on the disclosure of how phenomena are socially connected(Breckenridge, 2014; Denzin & Lincolan, 2000; Draper, 2015; Rice, 2014).

3.2 Description of the Study Area

The fieldwork data was collected between the 1st of December 2015 and the 30th of September 2017 in Dambakurima village of Muzarabani District, in Mashonaland Central Province, Zimbabwe (see Figure 3.1). The area extends from 16°00' S, 30°45' E towards 16°30' S, 31°20' E (Madamombe, 2004). According to the (ZIMSTAT, 2013a) Muzarabani District is one of the ten that fall under Mashonaland Central Province that also include:, Bindura Rural, Bindura Urban, Guruve, Mazowe, Mbire, Mount Darwin, Mvurwi, Muzarabani, Rushinga and Shamva. Mashonaland province has a population size 1,152,520 with a population density total of 40 persons per square kilometre (ZIMSTAT, 2013b) .Muzarabani District where Dambakurima ward is found has 122,791 with an average household size of 4.5 (Zimbabwe National Statistics Agency, 2012b). The district occupies a total land surface area size of 2,744 square kilometres of the northern part of Zimbabwe with Mozambique to the north at 310 05' E and 160 25 (ZIMSTAT, 2013b). The Dambakurima area is sparsely populated and is characterized by the rural poor with low levels of resource base and literacy. The Muzarabani District is mainly populated by the original inhabitants of the area, the *Vakorekore* people. The *Vavhitori* and *Vazezuru* are the minority ethnic groups in the area. Within this district there are 29 wards; however, this study specifically focused on Ward 1 known also as Dambakurima with a total population of 7032 people (ZIMSTAT, 2013a). It is from Ward 1 the purposively sampled population was drawn. Dambakurima (see Figure 3.1) was purposively selected due to its unique demographic, ecological, social, political and economic characteristics, as well as its identification in literature as an area most prone to extreme flood and drought episodes (Maruza *et al.,* 2017; Mudavanhu, 2014).

It is well documented that Dambakurima texperiences recurring floods every three to four years (Madamombe, 2004). The area experiences very low, erratic rainfall varying from 350 mm to 650 mm per annum (Zimbabwe Meteorological Services Offices Report, 2013). The area is semi-arid and experiences only two seasons namely: rain season (October to March) and a dry season (April to September). The study area has seen an influx of population due to environmental migration. The district lies 300 kilometres from Harare, the capital city of Zimbabwe and is situated along the Mozambique-Zimbabwe border in Mashonaland Central Province of Zimbabwe.

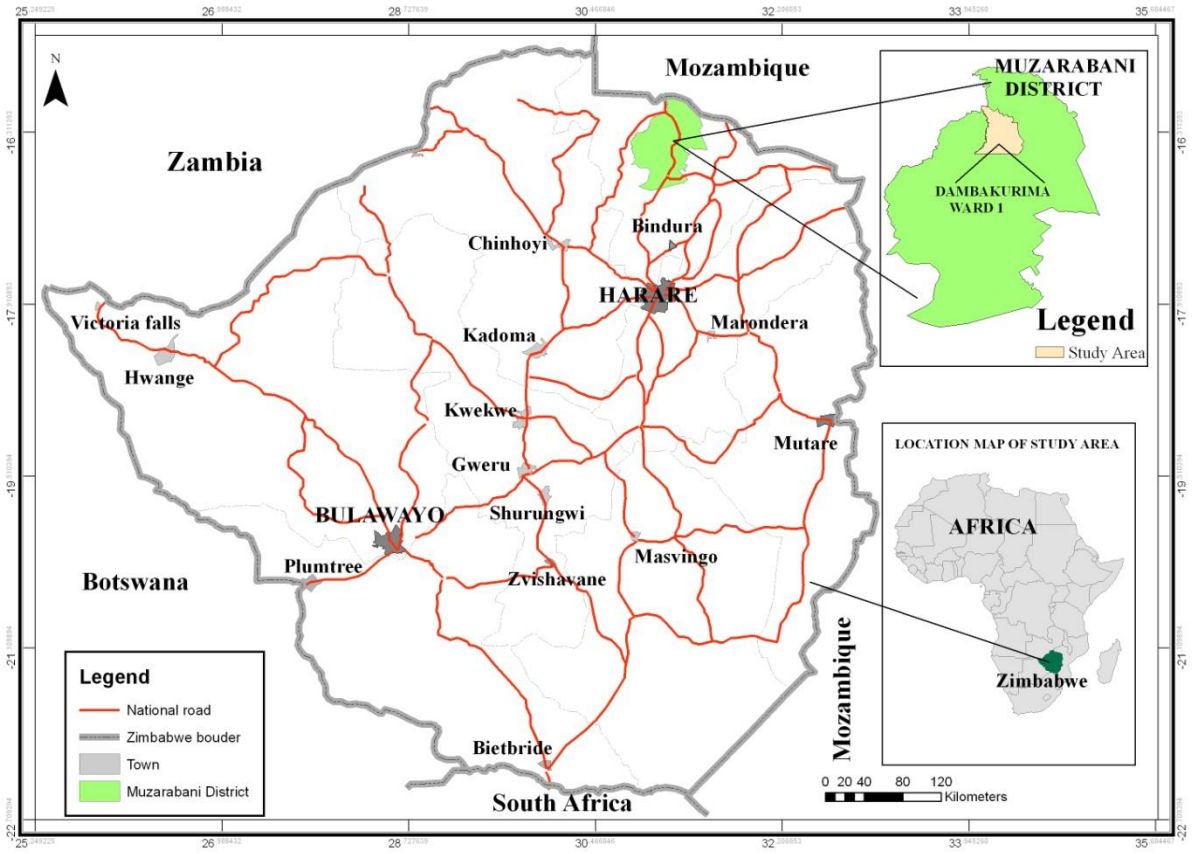


Figure 3. 1: The Study site in Dambakurima village of Muzarabani District, Zimbabwe

Source: Cartography unit (2017), School of Geography and Environmental Studies, University of Witwatersrand, South Africa.

The majority of Damabakurima villagers are dependent on agriculture and forest resources for their livelihoods. The area is also endowed with a diverse range of wild fruit trees; *Ziziphus mauritiana, Adansonia digitata, Diospyros mespiliformis and Strychnos innocua.*

3.3 Research design

The study used an ethnographic approach to provide insights into the Dambakurima community's eco-based livelihood experience and interactions, *Ziziphus mauritiana* and other actors in Muzarabani District. The study embraced a blend of qualitative methods: ANT, CCA, document reviewing, and ethnography **(**GT) for analysis. The literature review and philosophical considerations discussed above helped the research to select the theoretical concepts and later for conceptual framework construction. The ethnographic mode used in this research tracked the actors in their course of network creation, their efforts to construct stronger ties; to observe how they compromised, bargained, schemed, united, and compressed their relations; how translations occurred and what actually was being translated. The researcher followed both human and non-human actors in their diverse networks in an effort to record how they mobilised, contrasted, and "held together". This helped the research capture an in-depth background of different actors (Latour, 2005). The researcher also employed ethno-methodology, a stream of ethnography that imposed on the way actors built their own social world and reality.

Latour (2005) maintains ANT is ethno-methodology, hence in the case study; the researcher used GT and ANT to understand the *Ziziphus mauritiana* network production and its meaning in association tolivelihood, adaptation and resilience options. ANT focuses upon how translation and enrolment occur (Latour, 2005; Alcadipani & Hassard, 2010). In line with ANT thinking, this study followed and made use of all relavant actors. In the same context a qualitative procedure was used to solicit data in a systematic way that ensured the study's research statement, aims and objectives were well articulated Table 3.1. The following research method was used during the data collection: these are document review, focus group interviews, semi-structured interviews and observation. These will be discussed below. A pre-study meeting with people in the study area was conducted to help shape the research questions. Access to the field was gained through structured interviews (Babbie, 2002).

Table 3. 1 : Research Design Matrix

OBJECTIVE	1) Assess the contribution of *Zm* to livelihoods and its role in building the adaptive capacity and resilience of the poor rural people through an analysis of the networks associated with it.	2) Assess the inferences and significances of formal and informal institutional arrangements related to access and utilization of *Zm* by local communities.	3) Examine the use of ANT as an approach that could enhance eco-based resilience and adaptation approaches in the Muzarabani District, Zimbabwe
ASSUMPTION	1) The people in Dambakurima village are aware of the role of *Zm* to their livelihoods during adverse weather conditions	2) Different actors have diverse approaches and perceptions towards the governance of *Zm*.	3) Diverse actors are involved in the use and management of *Zm*
RESEARCH QUESTION	1) What are the benefits of *Zm* fruits to the locals?	2) What are the importances of different actors in the management of *Zm*?	3) What are the perceptions of the diverse actors in Dambakurima village Ward 1 towards the use of *Zm* and its management
ACTIVITIES AND ACTORS	1) State the different uses of *Zm* fruits found in the area	2) Some of the people only pick the *Zm* fruits that fall on the ground.	3) Some Human and non- human actors are involved in the management of *Zm*
QUALITTATIVE INSTRUMENT USED	1) Key informants interview and questionnaire as well as observations	2) Key informants interview and questionnaire.	3) Key informants interview and questionnaires administered as well as observations.
RESEARCH RESPONDENTS	1) Elders above 30 years both males and females Local leaders Officials from non-governmental and governmental organisations	2) Elders aged above 20 years both males and females Local leaders Officals from non-governmental and governmental organisations	3) Elders with the age above 20 years both males and females Local leaders Non-governmental organisations

Source: Field-based material 2017.

3.3.1 Grounded Theory and Actor Network Theory

Following the procedures recommended for qualitative research and GT according to Strauss and Corbin (1994), the grounded theory approach was used to code data. GT assisted in understanding data, but needed support to clarify complex interactions. It was used in conjunction with ANT and CCA in order to guide the process of data analysis (Strauss & Corbin, 1994). The primary reason for combining ANT, CCA and GT lay in the anticipated complexities of data which called for different analytical approaches. These three approaches are fundamental methods useful in research of subjective experience and meaning. GT enabled an iterative coding process that identified the emerging concepts.GT then examined empirical evidence for their support, consolidating similar concepts to create more refined ideas and fordata collection until theoretical saturation. Data analysis was based on open coding, axial coding, and selective coding (Strauss & Corbin, 1990). It was anticipated that this longitudinal and qualitative research approach would provide a rich dataset that would allow the creation of a chronology of the project related to the stages of ANT translation and CCA. The actors' identifications were guided by the interpretation of the interview transcripts, observations, audio recordings, and reviews of official and non-official documents. Attention was given to non-human actors like *Zm* by tracing associated actors and networks and exploring the significant role that this fruit tree plays in the daily lives of the locals, as well as its role in resilience. ANT allowed the study of actors as they presented themselves, as opposed to being controlled by apredefined theoretical context. Callon (1986) suggests that an actor's scale, power and motives behind actions are not all predetermined.

3.4 Study population and sampling procedure

Muzarabani District is prone to extreme climate variability, it would be more informative and rationale to interview the entire communities found in different parts of the district. However, this was impossible due to financial, time and logistical constraints. The study instead focused on the Dambakurima ward because of the following: there is widespread use and over exploitation of *Zm* caused by the interaction of different actors, and, above all, the area experiences the worst known climate variability challenges in the district Denzin & Lincolan (2000), the community faces resilience and adaptation option challenges; there are both human and non-human actors in the study area that influence the governances of *Zm*; the community use and depend on *Zm* as a source of livelihood and as an adaptation option strategy. The researcher was also familiar with and established contacts in the area, ensuring easy access to places and people. The exploratory nature of the study required purposive sampling to select actors. However, methodologically, the actor-network school of thought is not prescriptive. Latour, one of the main proponents of ANT commands that we basically 'follow the actors' and trace their activities in all that seem relevant to them. To appreciate, through the use of ANT, how *Zm* is used in the Dambakurima village of Muzarabani, there was the need to identify relevant actors. Individuals or groups constituted human actors. Interviews were conducted with human actors involved in the use and management of *Zm* in the Muzaraban District, in particular, those actors that focused on the day to day *Zm* interactions.

The primary procedure to identify actors was purposive sampling; therefore participants who could offer insight into this Muzarabani case study were requested to contribute. The main

intention of purposive samplings is to confirm that samples chosen are of importance to the objective of the study and that they are independent and offer unbiased scrutiny (Corbin & Strauss, 2015; Bryman, 2016). The population and household information for the study sites from the Zimbabwe 2012 Census report were used to increase the precision of the sampling procedure. Most households nominated practised some level of *Zm* management, from one *Zm* tree to many; only some environmental household migrants in the area had no *Zm* trees. The identified case study households provided a selection of in-depth views, 30 households were interviewed. Each selected household was at least interviewed three times, and effort was made to interview when possible household heads both male and female. The focus of the first scheduled interview was to solicit basic information around household characteristics, *Zm* use, livelihoods, and agricultural experiences. Each household was then interviewed two additional times during the rainy season (December-April 2016) and the *Zm* peak harvesting season (July-November 2017). The second (December-April 2016) interview schedule was conducted as an environmental scan of the prevalence, effects of climate variability and how the community responded. The third interview was carried out as a walk around the actual homestead, fields, garden and wild sites, such that there was a constant reminder of the material presence of the *Zm* in these sites and day to day activities. The purposive sampling technique was used to ensure that there was an adequate correspondence between the sampled and the targeted population. This was done to establish actor roles and networks with stakeholders and ascertain how these affect the use of *Zm*. However, the challenge faced was locating actors who were not part of the network and those who overstated their networks. This was only solved by making use of snowballing as a complementary technique.

Snowball sampling was used to complement and broaden the number of actors in the study. Snowballing is a sampling technique which involves ascertaining an eligible participant/s, through whom the researcher is interconnected to another participant/s that fit the study conditions (Neuman, 2011). According to Hammersley & Atkinson (2007)snowballing technique can use influential or powerful people in the community to increase the respondents' base. The study using the technique identified critical actors in the discourse easily, for example, community elders, leaders and other actors.The reconnaissance survey stage led the researcher to establish rapport with many Dambakurima villagers, and, through informal meetings, observation, interface and discussion with several groups of actors/people in market spaces and in other social places. The researcher managed to select eight local key informants. Key informants are individuals perceived to have certain insight or ideas about the theme under study. They may be locals or ordinary people and not essentially the experts, the better educated, those in control or the bureaucrats (Flyverbom, 2015). In this study, the central criteria for choosing the key local informants were their ages, irrespective of sex, particularly the old (above 60 years), and those assumed to have extensive knowledge of the Dambakurima indigenous cultural practices related to *Zm* use and management as well as response to floods and drought. In addition, their experiences were supposed to reflect, both today and in their past, today and future and lastly, their duration of stay in Dambakurima. Eight key informants were selected from the villagers based on the above-set criteria. Four were female and four were male interviewees who all were elders of the village. The interviewed, were all volunteers with relevant information towards the study.

The researcher also relied on networks developed earlier, while in Harare capital city of Zimbabwe. Draper (2015) argues that gaining access entails balancing between strategic as well as ethical concerns in relation to the research focus, time frame, and prevailing settings. During the initial stage of the study, the parent ministry of rural and local government in Zimbabwe was contacted, who upon an explanation of my research aim and objectives, provided connections with other eligible participants. The researcher had to set eligibility criteria for participation for key informants, which was limited to at least nine organisations, namely the four government organs and five registered non-governmental organisations that operate in this ward. These organisations are listed below, and the reason for inclusion was due to their involvement in environmental issues that includes hazard response such as food security. Organisations selected were namely: World Vision (which focuses on environmental issues, specifically water and sanitation); World Food Program (WFP) (which offers food relief to victims of environmental catastrophes), Southern Alliance for Indigenous Resources (SAFIRE) (which focuses on supplementary feeding), Fachig which supports livelihood strategies through provision of farm inputs, and the International Federation of Red Cross (IFRC) (which also focuses on environmental issues that include livelihood, food aid, and hazard response mitigation).

3.5 Research techniques and data collection

A combination of data collection methods was used to generate both primary and secondary data. This approach is termed triangulation (Babbie, 2001; Holloway & Wheeler, 1996; Ritzer, 2004). Triangulation is a more comprehensive, holistic and appropriate way of describing issues or problems under study descriptively. It was crucial, as it has several advantages over any single method. Triangulation is a more comprehensive, holistic and appropriate way of describing issues or problems under study. The consideration of human nature, social and ecological complexities where solutions are needed can be well articulated through triangulation. Both qualitative methods and data sources were employed to address the research problem. The data gathering instruments included document reviews, semi-structured interviews, observation, and focus group discussions. With the aid of the above-stated data collection tools, this study explored the significance of *Zm* in the lives of the people of Muzarabani and the role it plays during natural hazard episodes. The research inferred different actors' roles and the social, physical and cultural connections that emerged from the use of *Zm*.

3.5.1 Document Review

The review of relevant documents was an ongoing process that provided the research with a deeper understanding of the social, political, economic and ecological contexts of *Zm* in Dambakurima. The formal documents were from government or other institutions that dealt with natural resource climate issues or non-formal documents. The research continued to review journals, working papers, government and non-governmental documents obtained from Muzarabani District offices, and legal regulations for eco-based approaches to resilience. For this study, the researcher consulted books, videos, theses and publications produced by regional and national academic institutions (e.g. University of the Witwatersrand, University of South Africa, Zimbabwe Open University, Bindura University of Science Education and University of Zimbabwe). Newspapers, internet searches and social platforms were used to gather data. One advantage of continually reviewing literature was that the researcher was made aware of what has

already been done or what was being done in Muzarabani and it allowed for the identification of information gaps, which should be a primary objective for any study at this level.

Document review helped to achieve the first objective, which was to explore the contribution of the earlier approaches to eco-based resilience or natural hazard mitigation literature and to understand the issues that had already been mentioned in the literature. The researcher repeatedly consulted these documents to ensure a deeper understanding of the research interest background. Through document review the researcher focused on ANT's principle of symmetry of recognising the role of non-human actors in seeking problems and solutions of governance of *Zm* and alternative natural hazard mitigation approaches. The researcher spent a minimum of 12 months collecting data, and continuously reviewed these documents to ensure that he remained well-informed of new developments. In relation to the second objective, which focuses on exploring the contribution of *Zm* to the lives of the rural poor as a hazard mitigation strategy in Muzarabani, the documents provided information that was already gathered from research on *Zm*. Existing policies and responsible actors were revealed through this data collection tool.Reviewed literature aided in indentifying research previously conducted in Muzarabani.

There were challenges that emerged when the research was attempting to access some of the documents, especially those from institutions. Taking ethical consideration and ensuring a good rapport with those in authority helped to overcome this type ofobstacle.

3.5.2 **Semi- structured interviews**

The study drew the much-needed information through semi-structured interviews as the main source of primary data. This was used as a guiding tool characterised by a list of specific, open-ended, informal and conversational questions (Neuman, 2011). This allowed room for information to flow and accommodated the introduction of new, important issues that were not initially programmed by the researcher. Semi-structured interviews' main strength lies in their ability to capture information from all actors in their own terms, irrespective of their literacy levels (Böhm, Glaser, & Strauss, 2004; Draper, 2015). All the previously mentioned entities were interviewed using this tool, which was used in conjunction with ANT. This tool assisted the researcher in identifying the major protagonists, examine *Zm* based relations among actors andexplore from important stakeholders the role of *Zm* and how it could be recognised as an important actor in the resilience and livelihood discourse in Muzarabani. The researcher conducted nine interviews with organisations that dealt directly with the Muzarabani community in terms of *Zm* and resilience as well as natural hazard and resilience issues.

The researcher made prior arrangements before conducting the semi-structured interviews. An interview guide with questions that sought to fulfil the research objectives 1, 2 and 3 was used. The main reason for opting for semi-structured interviews was to limit the dialogue to *Zm* and its governance related matters. In the same context, the semi-structured interviews were used in a manner that allowed the interviewees to speak freely concerning any information arising that was found exciting in relation to the role *Zm* played for the Muzarabani community. The researcher received prior informed consent to record the interview conversations and the interviewees' contributions were anonymised. The research, in line with ANT's teaching of following the

actors, followed various actors and tried to establish their connections with *Zm* and its governance.

3.5.3 **Observations**

Another important tool used in this research was observation. This entailed choosing to visit the study area at will, check listing, and the use of a recorder to capture information. The researcher, through observations, was part of the community and observed the uses of *Zm* hazard mitigation strategies, *Zm* networks, an array of both human and non-human actors, and social and ecological activities. According to Aldiabat (2018), the researcher forms the core source of primary data collection in ethnographic or qualitative studies. The researcher made use of field observation as part of the formal tools. This tool enabled him to see, hear, perceive and be accommodative to any source of information that related to the role of *Zm* and its networks.Observations helped to achieve at least two of the research objectives. Firstly, through examining the major protagonists and interrelationships of power amongst them as they sought to manage *Zm*, and secondly through assessment of the contribution of *Zm* for the rural poor related to times of natural hazards in Muzarabani. The researcher strived to be part of the community observing and capturing first-hand information in efforts to follow the actors. Observation exposed the networks of all focal and non-focal actors through observing; discussions, conversations, conflicts, negotiations and all interactions that prevailed among actors. The researcher ensured that there was no interference with the actors in anyway; even in meetings. Meetings were observed according to informations related with *Zm* and its governance at a local level, district and national level basing ideas from Denzin & Lincolan (2000). No less than 10 meetings were attended. Extensive field note-taking was completed when granted permission to do so and the role of *Zm*, was noted down. The notes were transcribed and cross-referenced with the situation on the ground. The research was cross–referenced with 20 observations and notes were taken on any variations.

3.5.4 **Focus groups discussions**

This method made use of all actors, including women, men, village elders, government, non-governmental officials and village heads as respondents. Structured checklists guided the interviews. Flexibility characterised the interview questions. Over 30 interviews were conducted to allow triangulation of responses.Focus groups and workshops helped to achieve one of the objectives, which sought to examine the major protagonists and interrelationships of power among state, community and non-governmentally linked institutions in the use of *Zm* and actor networks in Muzarabani District. The research used focus group interviews to solicit information from the Muzarabani community with respect to the role of *Zm* and commodity chain issues. Focus groups and workshops are known and acknowledged as effective means of collecting data especially from isolated vulnerable communities such as those in Muzarabani (Draper, 2015).Thismethod was used to unearth the wealth and value of the Muzarabani community's knowledge and culture concerning *Zm*. The method also ensured that various actors such as government and non-governmental organisations officials were accorded the chance to be heard. Hence, they were informed of various group discussions that took place. Pre-determined, semi-structured questions formulated by the researcher were used to guide interviews, which were relaxed and held in informal settings.

The community was informed through community leaders of the focus group discussions and the intention was clearly stated to deter suspicion and mistrust. To ensure effective communication, trained interpreters were used to translate local languages *(Chikorekore)* and English. Focus group discussions enabled affected individuals and communities to openly express themselves. This presented knowledge that improved the ability to understand the perspectives of various actors in Muzarabani. Focus group discussions embarked on collecting data regarding the role of *Zm,* and itsgovernance mechanisms in place. The Muzarabani community is still patriarchal. It was anticipated that challenges could arise when the researcher engaged both women and men in focus group discussion. The research was therefore organised in such a way that groups were organised according to sex and age. This enabled the researcher to capture real-life information in a flexible, social, and conducive environment. The focus groups constituted women aged 15 to 50, men aged 15 to 50, women aged 50 and above, and men aged 50 and above. Lastly, one group comprised of both women and men without restrictions. Convenience sampling was used to sample those members of the village above the age of 50. Only willing members were used in these discussions. A total of 40 community members participated in the focus group discussions. There were five groups, each comprising of 8 people. Time was allocated to each focus group and remained consistent for each group, though not binding. It was anticipated that additional all-inclusive information was acquired from the focus group meetings. The following was the solicited information from the community when the focus groups were conducted. Issues discussed included the following themes:

i. The role of *Zm* in their daily lives and during hazards episodes;

ii. Actors in *Zm* management and utilisation*;*

iii. The *Zm* networks;

iv. Positive and negative effects of *Zm*'s governance;

v. Power relations between communities, government and non-governmental organisations on issues to do with *Zm*, management.

The use of focus groups helped the researcher to learn more about social and ecological complexities and the networks within the groups. As an essential complementary tool, workshops were used and went beyond focus group interviews. These involved the use of charts and green boards to solicit information or achieve specific collective tasks. The main advantage of workshops was that they encouraged active participation from respondents; hence complex eco-based issues were well articulated.

3.6 Data analysis procedures

The data were analysed qualitatively using thematic analysis. Themes were identified, analysed and reported across all data sets (Yin, 2014). Themes identified were the identification of the actors (institutions), the role of each identified institution, the challenges faced given the existing institutional order, and the proposed strategies to enhance effectiveness and sustainability of utilising *Zm* among diverse study variables.

3.6.1 **Grounded theory**

Grounded Theory (GT) is a methodological approach which emphasises the building of theory in relation to the specificity of the case study. It is based on minimum theoretical assumptions. The theory relies heavily upon the coding processes, data collection and data analysis (Glaser& Strauss, 1967). The GT approach used in this study entailed interviewing a sample of the Muzarabani population about their relationship with *Zm*, and the role it plays in resilience options. Concurrently the semi-structured interviews and coding components of transcripts were recorded(Bernard, 2006), at the same time describing these in terms of the community's relationshipwith *Zm* (Charmaz, 2006). Data from semi-structured interviews and observations was analysed according to the coding protocols of GT. Coding meant using a word or concept that describes what is behind the known (Thomas & James, 2006). Coding nurtured the analytic structure and presented the frame for the analysis and linking the researcher's view with empirical reality. Charmaz (2006) perceives coding as an imperative link to data collection and developing theory. Coding underscores the crises, issues, problems and concerns of those being studied. Interview coding was used to comprehend how people related the role *Zm* played in their experiences of livelihood and resilience. In addition, data from other sources, such as current literature was used to categorise and link the data to ascertain relationships with *Zm*.

Coding was the first stage of data analysis, and it helped to shift away from particular assertions to more conceptual explanations of the interview data (Thomas & James, 2006; Barbour, 2008). Conceptual labels were assigned to almost every line in the interview transcript in order to gather the "said" information. The interviewees' own words, which are known as vivo code, were used to concentrate closely on the perspective of the interview (Aldiabat, 2018). Codes were then assigned to interviewees' words to develop similar concepts to the starting point of an analytic process. Line by line coding (open coding), and an analysis were done on the collected data obtained through observation and interviews (Böhm *et al.,* 2004). Careful and in-depth line-by-line coding facilitated a different inference of the transcript. Two analytical approaches were used. Firstly, collected data was sorted and then sub-divided into workable themes according to the objectives, 2, 3, and 4 of the research. Secondly, the researcher explored the information in order to interpret it by breaking down the whole into small parts, eventuallyreassembling the parts or units to fully capture and interpret interrelationships or associations. Comparing, contrasting and labelling the text data before, during and after collection of the data phase, helped to establish webs of connection in Muzarabani. GT was helpful to the researcher as it created themes and sub themes as prescribed by the research objectives.

Focused coding, which is more conceptual than open coding, was undertaken. Focused codes ensured that the codes selected from a transcript were those that best represented the interviewee's voice (Böhm*et al.,* 2004). The focused codes were functional and "tested" in additional interview transcripts which assisted in proving the capability of the initial notion developed. Subsequently, axial coding took place, which was the phase where themes were related along their lines of dimension and properties (Aldiabat, 2018; Breckenridge, 2014). Charmaz (2006) argues that axial coding reconstructs data that has been broken up into disconnected codes using line-by-line coding. Analysis of roles, resilience and livelihood strategies based on the use of *Zm* were presented from the data gathered through the semi-structured interviews. This was done using axial coding. Charmaz (2006) suggests that axial

coding results in a data analysis framework that is too formal. Instead she proposed the less formal approach of demonstrating a way of making sense of categories that have been linked like how *Zm* could help rural communes during natural disaster episodes.

Theoretical coding explored the relationships established between categories. According to Böhm *et al.,* (2004) theoretical coding refers to the stage where the researcher discontinues collecting new data and concentrates on the relationships between prevailing categories. The process of coding involved in the first step after coding the interview transcripts identified the many primary concerns of the respondents. These concerns were assigned an abstract label representing a code. Codes varied; some shared the same characteristics and were linked together (Charmaz, 2006). GT methodology does not advocate using quantitative data to deduce meaning. Frequency counting of categories was used to inform the research and the interviewees' concerns which were significant (Charmaz, 2006; Thomas & James, 2006). When presenting findings, the development of the core category was described. Charmaz (2006) distinguished coding as an imperative link in collecting data, and as a link between the researcher's view and empirical reality.

Thematising the preliminary analysis included the identification of actors, and the strongly intertwined relationship between *Zm* and the lives and livelihoods of the people in Muzarabani. Networks that emerged, adaptation and resilience options available, non-governmental organisations and government power relations were drawn from the analysis. Discourse analysis, which recognises language as an important tool that generates meaning and comprehension of the Muzarabani community's interactions and experiences in times of hazard was used (Mills & Birks, 2014). Discourse analysis was used to examine different verbal and visual systems, signaling and behaviours. The prime concern of discourse analysis is how the *Zm* associations are expressed. Ultimately, the research searched for themes and associations.

GT in itself is an assembly which espouses the decisions of the transcriptions (Thomas & James, 2006). Transcribing entails translating oral language to a written language, each with different rules (Neuman, 2011). In the same context, transcripts are interpretive in nature and are not wholly a true representation of reality. To preserve accuracy and a sense of honest discussion, transcripts were taken word-for-word. Translations are an essential concept in ANT, andare defined as the processes that create ordering effects, for example, the different forms of actor networks such such as policies, trees, agents and organisations (Law, 1992). ANT is perceived as a continuous process, which pronounces the movement of an array of forms such as cultural practices, knowledge, technology and artifacts (Czarniawska& Hernes, 2005; Law, 1992).

The GT goal is to remain as faithful as possible to the original transcribed text, while removing obstacles that would otherwise impede readers from understanding. This involves a judgement by the researcher, but so too does transcription and the choice of which excerpts to use. A transcription service is sought from practicing translators. Interview questions gave the interviewees as little guidance as possible, allowing them to reveal what is important to them on a given topic (Bernard, 2006). In extracting those phenomena or experiences significant to the interviewee, a conceptual label known as a code was assigned. Numerous codes are grouped into conceptual classes, which ultimately structure the foundation for the development of a theory (Sarker & Sidorova, 2006). In support of GT, ANT was used to ensure in-depth analysis of *Zm*

networks in Muzarabani as they related to livelihood, adaptation and resilience approaches. However, the frequent counting of categories confirmed the significance for the interviewees. The result of the research was shared with interested parties in Muzarabani, policy makers and the academic world as a new Actor Networked Eco-based Resilience Logic Model (ANERLM) was created.

3.6.2 **Actor Network Theory**

The ANT methodology was used to analyse data acquired through field work. It focused on group discussions, observations and interviews in people's places of work. Law (2003), suggests that by its very nature, ANT is easier to describe in the course of a demonstration of its use. ANT derived methodology exposed the complexity involved in the use of *Zm*andlivelihood, adaptation and resilience options. ANT's entire components were used as a way of finding ways to enhance resilience or livelihood, adaptation and resilience options. In the same context, the ANT approach enabled the researcher to probe the networks, which have been nurtured and defined by its parts, followed by questions about the type of actors in the heterogeneous study landscape, which included both human and non-human actors. Major themes used in the analysis of the observations and interviews werebased on the process of translation (Law, 2007)namely: enrolment, and the correlated thought of inscription (Dymond, 2014; Latour, 2005). Actants were first identified, and then followed until they became stable. According to Ritzer (2004), ANT is both a theory and an application method or approach to analysis. Human and non-human actors were considered the primary and only contributors in the quest for the sustainable utilisation of *Zm* as an alternativelivelihood, adaptation and resilience approach. This was based on the translation processes, namely: (1) problematisation (identification of problems and solutions); (2) interessement (follow up of a defined problem by those interested); (3) enrolment (performance of actors to prescribed roles); and (4) mobilisation (stabilising and creating new networks)(Callon, 1986; Hitibandara, 2017).

The ethnography method used in this research helped to track the actors in the course of their network creation, to analyse their efforts, to construct stronger ties, to observe how they compromised, bargained, schemed, united and compressed their relations, and to explain how translations occurred and what was actually being translated. The researcher followed both human and non-human actors in their diverse networks in an effort to record how they mobilised, contrasted, and "held together". This helped capture the in-depth background of different actors for the research (Latour, 2005). The researcher employed GT to aid in data analysis.

3.6.3 **Problematisation**

When working in GT mode the primary objective was to investigate individual and social practices in Muzarabani. This was done by taking empirical findings to a higher level of abstraction and developing meaning. Problematisation in context referred to the process where actors were sure that the network could find a solution to an identified problem. The actors offered a consensus solution to an identified problem to the extent that the network was important to the actor's survival. At this stage, actors participated consciously or unconsciously by enrolling other actors to uphold facts in an attempt to structure the nature of the problem in

their own terms (Sarker & Sidorova, 2006). In this regard it was important to identify the problem, the actors and the networks in the Muzarabani hazard landscape by gathering information from the respondents. This was done through reviewing relevant documents. The documents provided a deeper understanding of the social, political, economic and ecological contexts of hazard mitigation options in Muzarabani. The documents used were formal, such as policies and legal frameworks, or non-formal documents from government or other institutions that manage natural resources and climate issues in the study area. These documents and their sources also became part of the wider network under discourse.

Interviews with organisations that dealt directly with the Muzarabani community in terms of the production, trading andlivelihood, adaptation and resilience using *Zm* were conducted. These included, but were not limited to, four government organsisations; Ministry of Local government and rural housing, Environmental Management Agency (EMA), Muzarabani Rural District Council (RDC), Civil Protection Unit (CPU), and five registered Non-Governmental organisations. The non-governmental organisations all operated in the Muzarabani Rural District. These included World Vision-(which focuses on environmental issues, specifically water and sanitation); World Food Programme (WFP) which offers food relief to victims of environmental catastrophes, Southern Alliance for Indigenous Resources (SAFIRE) (which focuses on supplementary feeding), Farmers Association of Community Self-Help Investment Groups Trust (FACHIG) (which supports livelihood strategies through the provision of farm inputs) and the International Federation of the Red Cross (IFRC) (which also focuses on environmental issues that include livelihood, food aid, and hazard response and mitigation). Generally, organisations that were included in the study had to meet the following charecteristics:

i. The organisation involved in some way in eco-based resilience strategies in Muzarabani.

ii. The organisation involved in sustainable use and resource management, specifically interested in *Zm*.

iii. The organisation which is a significant actor in the study landscape.

iv. It is involved in natural hazard issues of the study area.

v. It is involved in policy formulation and implementation.

The interviews made use of open ended questions. As noted by Bernard (2006)questions enabled interviewees to express themselves openly within the realm of the exact themes. Codes from collected data were assigned during the initial coding stage. Each code was maintained by two or more text segments. The axial coding stage merged codes that were conceptually similar. Finally, during selective coding the identified codeswere incorporated into the analysis. A storyline emerged offering a coherent and insightful account of the eco-based resilient approach initiative. Muzarabani's assemblages of human and non-human actors was studied using the ANT approach of following actors who bypass and over spill from the original entry point into those beyond the study area. The scale or limits of actors were not recognised by geography, but by the process of translation completeness which was followed and mapped-out. In the same context, power relations were explored in relation to different actors and inevitably the politics of

livelihood, adaptation and resilience options. The networks were of interest rather than the power in the day today context of being able to control the management of *Zm* in Dambakurima. In the end the stability of the networks were of interest to the researcher because they signified the position of the actors. The study framework helped to inform how networks became stable. In this respect the tools of observations and interviews took precedence as the researcher took notes and audio recorded the information.

3.6.4 **Interressement**

Interessement is another form of translation whereby an actor coerces groups of actions to the extent that they agree with its appeal (Callon, 1986). Under this arrangement there is a weakening of those against the idea, and those in agreement with the idea are strategically positioned through its problematisation (Linde *et al.,*2003; Tatnall & Burgess, 2002). This was supported by specific wording in the invitation letters to the 2016 and 2017 interviews. In order to understand the interessement, observations of meetings that had to do with *Zm* and resilience in Muzarabani at a local level, district and national level were done.In GT mode of generating new academic knowledge, extensive Muzarabani empirical field work was done together with a multi-stage data coding and interpretation process.

Interviews and observations captured those who were interested in the identified problem. There was a need to understand the controlling actors in terms of how they achieve a successful interessement. Different strategies and tactics were deployed to get the focal actors (Sarker & Sidorova, 2006). A common strategy was to build devices and place them between the controlling actor and those being interested (Callon, 1986). The use of representatives is another strategy in which the controlling actor negotiates interessement with those who speak for others (Alcadipani & Hassard, 2010; Wessells, 2007). Focal actors need to have different strategies to ensure actors for interessement might at the same time be enrolled in the problematisation stage of other networks, hence emerging as participants in the new networks. It was in the interest of the research to observe, interview and follow the focal actors in the study area. However, it must be noted that for any network to be successful, those who resist or are against the aims of the network need to be side-lined (Callon, 1986). Interessement needs to be continuously reinforced by enrolment (Callon, 1986; Czarniawska *et al.,* 2005).

3.6.5 **Enrolment**

In ANT terms, enrolment denotes the process by which actors are part of a specific network. As mentioned previously, an actor or actant in an actor-network can be human or non-human; consequently, a network in an actor-network is a heterogeneous assemblage of actors (Flyverbom, 2015; Latour, 2005). The actors enrolled in the actornetworks described in this work included the *Zm* and any other person, policy, phenomenon or idea that became necessary for hazard mitigation in Muzarabani. The power of ANT, demonstratedthrough interviews, observations, audio recordings and photographs how essentially entangled the different elements of eco-based hazard mitigation are. Callon (1986) suggests that there is more to the success of alliance and eventually translation. Interessement needs to be continuously reinforced by enrolment to sustain the links between actors (Law & Hassard, 1999).

3.6.6 **Mobilisation**

The concluding moment, mobilisation of allies; occurs when enough actors in the network with the same belief and behaviour are gathered in one place and can no longer withdraw (Sarker & Sidorova, 2006). Mobilisation refers to a set of methods used by key actors to confirm that the spokesperson represents the interest of the network and do not betray them (Latour, 2005). In Muzarabani, this meant that the actors in the *Zm* networks answered questions such as: are the delegate actors representing the people? Who is representing them? In whose name is the speaker translating? Networks can fail to stabilise and disappear, while those that are successful will remain to grow. Heterogeneity is central to the stability of a network; networks grow and stabilise and determine future translation approximation (Latour, 2005; Sarker & Sidorova, 2006). ANT claims that ideas of space and time, termed as having a stringy, fibrous, ropy and capillary character, are complex (Flyverbom, 2015; Latour, 2005). Mobilisation is known to have a multiplying effect which depends on making use of representatives of the masses; and in it supposing their followers will join. The success of a translation depends on an array of factors which include misrepresentation of facts and resistance from other assumed followers (Latour, 2005).

ANT moments reflect the different stages of the overall process of translation. The moments from which the actors are identified; the likelihood of interaction and the limits of manoeuvre are discussed and delimited. However, the four moments can at times overlap at the end and a compelling network of relationships will be built (actor-network) (Latour, 2005). ANT puts emphasis on the burden of theory on the recording, not necessarily on what is being recorded. Furthermore, ANT suggests that actors may be human or non-human, that they are heterogeneous, know no differences of scale, that there is no inertia, that they are free associates, no order and that they build their own destiny (Latour, 2005). This does not qualify any real observed actor but is the necessary condition for the observation and the recording of actors to be possible and ANT makes noassumption.

3.7 Limitations of the Study

The study focused on the use of *Zm* in Zimbabwe in the context of the eco-based resilience in semi-arid rural spaces. The participants were chosen from positions relatively apart from each other and dealing in diverse activities, products, markets and actors. The relative detachment between the locations made the field work exercise burdensome. Lack of cooperation and willingness from some participants to be part of the study limited the process in the data collection. Most of the government officials persistently referred the researcher to the government head offices in Harare to access official documents or records. This limited the study in that most of the information provided was rehearsed thereby to some extent lacking the lived experiences of the people working within the environmental departments in the chosen government departments. This also meant that the information given out from the Head offices was not only specific to the Zimbabwean context but masked the entire district under the parent organisation. Going through the many copies of reports to gain understandings into the Zimbabwean context precisely became very strenuous and time involving. The researcher made use of websites of diverse actors to access eco-resource, resilience and climate change reports to overcome the difficulties that went up in accessing information.

World Vision, a non-governmental organisation operating in Muzarabani, from the onset declined to participate in the study underlining that they did not have the mandate to avail confidential facts to the civic. Non-governmental and governmental organisations in Zimbabwe are, however, bound by Zimbabwe: Official Secrets Act, Chapter 11:09, of, 1970. This Act inspires secrecy, accountability and transparency in both civic and private divisions. The other technique used by the researcher in light of the barriers, was to follow the *Zm* according to the ANT from the production to the end user in and outside Zimbabwe. This provided understanding into the level of *Zm* exploitation that occurs in order to facilitate the commodity chain process that enhanced resilience and livelihoods.

In carrying out the fieldwork, the researcher was constantly interjected by overzealous political actors in the study area and this made it difficult to access the study site. However, this was overcome by creating a rapport with the traditional and government leaders. This meant that the researcher was always guided and protected by assigned locals from the traditional leadership. Camera and other electronic devices were prohibited by the traditional leaders and the Muzarabani Rural District Council and this limited the number of pictures taken to provide an insight of the various aspects that characterize the production and marketing of *Zm*. Because taking pictures according to the tradional leaders could potray a different image of the community and could also be used by some politicians to gain political mileage it is an activity that they discourage. More pictures would have aided and enriched the study as it would have underscored the various aspects that go into *Zm* production, distribution and gender aspects, and the level at which diverse actors are organised in the *Zm* to cite a few characteristics.

CHAPTER 4 [2]

EMPERICAL EVIDENCE

4.0 Introduction

This chapter presents the empirical evidence that was collected between 2nd of December 2015 and the 30th September 2017 to address the research questions used in this study. The premise of this chapter is to highlight what the research sought to investigate and the findings obtained thereof. Key themes were drawn from the research questions and important data was extracted from the content. The themes were categorized in relation to the research questions and important data from the content. To confirm data that was relevant to the essential questions was picked all patterns that were established in the data were put into categories. These themes were established over repetitive reading and revising of the data content. Through this process theme responding to the research questions were drawn and utilized to establish an overall understanding of the way in which the Muzarabani community adapts using the *Ziziphus mauritiana* to align with the effects of climate variability demands for their search for profit and survival.

The themes that emerged include: firstly the role of the *Ziziphus mauritiana* in local household economies and the significant role the eco-resource plays in affecting livelihood and resilience in the semi-arid space of Dambakurima in Muzarabani, Zimbabwe. Secondly the interpretations and significances of formal and informal institutional arrangements related to access and utilization of *Zm* by local communities. Thirdly, the examination of the use of ANT as an approach that could enhance the adaptive capacity and resilience of the poor people in the Muzarabani District, Zimbabwe. The chapter identifies diverse actors and their interaction with *Zm*. The eco-based linkages are explored and the highlighted synergies, dichotomies, and likely eco-benefits from *Zm* during and after hazards are revealed. This chapter presents the data onto tables, bar graphs, plates, and excerpts from interviews.

4.1 *Ziziphus mauritiana* uses their and importance in Dambakurima

Eco-resources such as wild fruits and vegetables constitute a significant part of the food culture and dietary requirements for the rural people in Zimbabwe. In Muzarabani District and more specifically in the village of Damabakurima, a significant number of the rural people are dependent on gathering of wild fruits, roots and vegetables for food and income generation. Field-based evidence for example, revealed that the gathering of wild fruits and vegetables is an important source of job creation that is central to the livelihood strategies of the people in Muzaranbani District. The District Administrator (DA) to Muzarabani for example, pointed out that;

[2] This chapter is based on a paper that has been submitted for publication with the Journal of Environmental Management and Sustainability. The paper is currently under review

> "Many people in Muzarabani appeared to be engaging in the collection of wild fruits, vegetables and roots for food and petty trading. However, these activities seem to be geared more towards survival, than as an indication of any kind of dynamic thrust in the rural economy. Both the collection, consumption and selling of these eco-resources had an aura of constant and vexatious frustration"
>
> (Pers.com, 2016a).

An inventory of the different types of wild fruits that are usually collected, their purposes and their uses are illustrated in Table 4.1.

Table 4.1: Most commonly collected wild fruits and their uses in Damabakurima Village

Scientific Name	Local Name	No of Respondents	%	Uses
Ziziphus mauritiana	*Masau or Masawu*	57	81	Food, brewing beer, income generation, medicine
Adansonia digitata	*Mawuyu*	6	9	Food and income generation
Diospyros mespiliformis	*Mushenje/Shenje*	14	6	Food, brewing of beer for traditional rituals
Strychnos innocua	*Hakwa/Mukwakwa*	3	4	Food
Total		**70**	**100**	

Source: Field-based material (2016)

It is suggested in Table 4.1 that an estimated 81% of all the responses cited *Ziziphus mauritiana* as the most widely collected wild fruit which is used for food, income generation and in some cases for medicinal purposes. A further 9 % of the responses cited *Adansonia digitata* which is also used for food and the generation of income. Having established the most common types of wild fruits that are gathered and their uses, it is important to identify the actors involved in the collection and management of these fruits and their motivation. Table 4.1 below shows the representation of the actors involved.The information in Table 4.1suggests that as many as 66% of the research participants involved in the collection of *Ziziphus mauritiana* were women and their primary motivation for engaging in this activity was to obtain food for their families and for income generation. Of the 66%, an estimated 36% were between the ages of 15 and 30 years. From the literature on fertility in an African context, this age is the child bearing age (Ringheim & Gribble, 2010). It would thus not be an exaggeration to argue that their involvement was necessitated by the pressing need to feed their families as well as to obtain finances for the procurement of other

services such as education and health. This assertion is supported by a female research participant in that age group who stated:

> "Women in our village work very hard. We have to go to the fields to cultivate, fetch water and wood and then go to look for, and prepare food for the family. I have no husband to do things for me and many women here don't have husbands. The men are either dead or are in town not gainfully employed. We have children to feed and send to school.").
>
> (Pers.com, 2016b)

A further scrutiny of Table 4.2 reveals that 23% of the men involved in the gathering of *Ziziphus mauritiana were* driven by the need to obtain financial resources.

Table 4.2: Actors and their motivation for collecting *Ziziphus mauritiana*

Gender	Age	No. response	%	Motivation
Male	10 - 14	3	4	For consumption and sometimes contributing to household food basket
	15 - 20	4	6	For food, income generation
	21 - 30	8	11	For income generation
	30 - 40	6	9	For income generation
	40+	2	3	Income generation
Female	10 - 14	8	11	For household food basket and income generation
	15 - 20	11	16	For household food basket and income generation
	21 - 30	14	20	For household food basket and income generation
	30 - 40	10	14	For household food basket and income generation
	40+	4	6	For household food basket
Total		**70**	**100**	

Source: Field-based material, (2016).

Only 10% of the men (and children) aged between 10 and 20 years alluded to the fact that they gather *Ziziphus mauritiana* for food and to trade for income generation. The scenario depicted in Table 4.2 points to the fact that men and women engage in the gathering for wild fruits for different purposes. It is clear from the information in Table 4.2 that the primary motivation for the women's involvement is both for the wellbeing of the household and income, whereas for the men, it's financial security. In addition to *Ziziphus mauritiaina* being a source of food and income generation, it is also a source of fodder which is used to feed livestock, especially during periods of severe drought episodes. A male research participant in the 20 and 30 years age group in Dambakurima stated:

> *"Zm* is not only important to people, but to our domestic livestock as well especially when we recieve no rain. Our goats enjoy the *Zm* leaves and fruits. It's the only tree that withstands the lack of water and it really makes goats grow big and fat. When we sell them, we make good money."
>
> (Pers.com, 2016c).

To emphasise the importance of *Zm* to both people and livestock as a livelihood source, a traditional leaderstated:

> "Our land is a very dry area and most of the times our crops and vegetation die because of lack of moisture. This place becomes very unbearable to live in because of the harsh weather conditions…people survival on *masau* (i.e. *Zm*) and other fruits for food".
>
> (Pers.com, 2016d).

To identify the different food consumption patterns a calendar was formulated in order to create an inventory of the different crops that were available at different time periods in a year by using a seasonality matrix shown in F igure 4.3.

Table 4.3: Food Availability patterns of households in Damabakurima (Scores out of ten).

Crop/month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec
Maize	2	1	-	-	10	10	10	10	4	4	4
Sweet potato	-	-	-	2	4	10	10	7	-	-	-
Ground nuts	1	1	6	10	10	10	6	4	2	2	1
Pumpkins	-	5	5	10	10	10	6	5	4	-	-
Okra	-	-	3	4	4	10	6	3	1	-	-
Wild vegetable and *Ziziphus.mauritiana*	10	10	10	10	10	8	8	7	7	7	10
Garden vegetable	-	-	-	3	4	5	4	5	3	3	1
Watermelon	-	-	6	10	8	6	6	4	-	-	-
Sugar cane	-	-	6	7	7	3	3	4	-	-	-

Source: Field-based material (2016).

From the information in Table 4.3 it is suggested that the period of seasonal stress to welfare and food security typically falls between August and March of every year. This period accordingly to Maruza *et al.*, (2017) coincides with increased weather variability mostly in the form of drought episodes. However, a careful scrutiny of the information in Table 4.3 reveals that during this period, households depended heavily on wild vegetables and *Zm* as sources of food see also Table 4.1. In view of this, it was important to establish the strategies employed by the Dambakurima community to ensure household wellbeing and income generation.

4.2 Strategies to cope with food shortages

Results indicated that 9% of food requirement by households' respondents in Dambakurima was produced in the community's own seasonal harvest. For the previous fifteen years crop yields had failed because of either drought or floods. However, the Dambakurima community in response employed a number of strategies (see Figure 4.1). Non-governmental organisations' (NGOs) relief food (52%) was the most common, followed by purchasing food from the local market (15%); the gathering of wild fruit like *Zm* (12%). Some households depended on livestock sales (7%) and the least common was the Presidential Food Aid Scheme (5%).Although 12% from the gathering of wild fruit like *Zm* appears statistically low in comparison to other strategies, it can be argued here that wild fruits and *Masau* in particular is significantly making strong bonds of social cohesion, an aspect that is important to resilience and livelihoods.

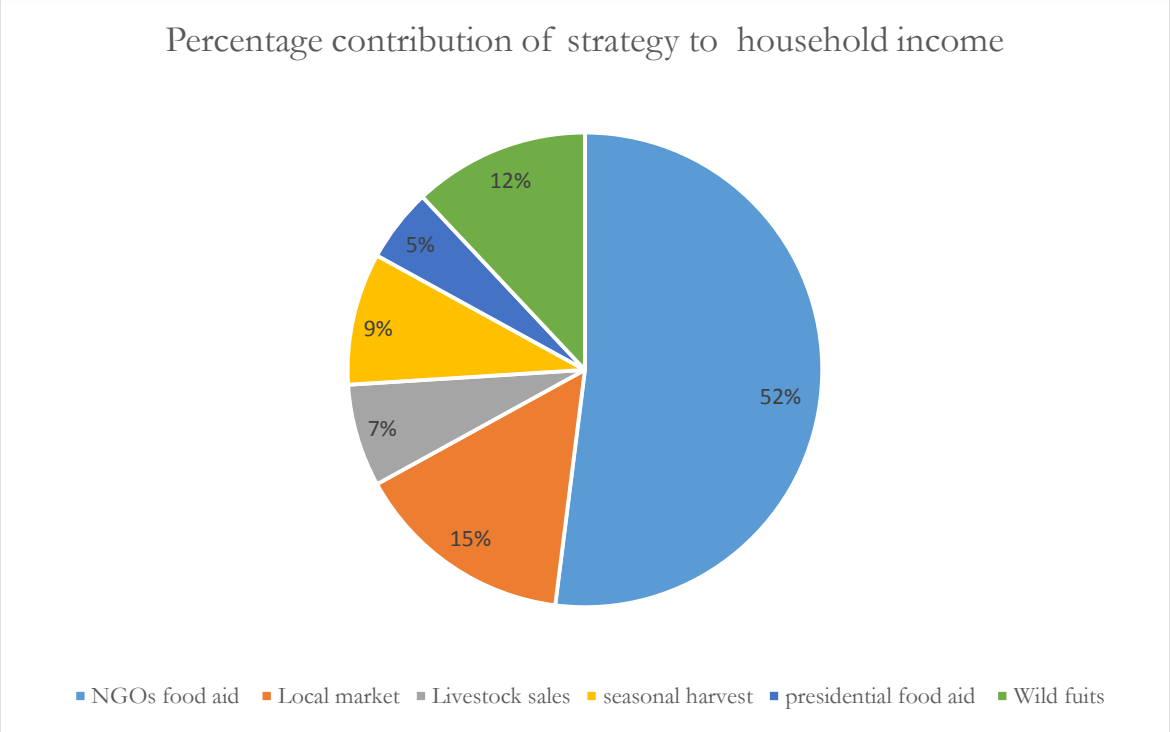


Figure 4. 1: Percentage contribution of strategy to household income.

Source: **Field-based material (2017).**

The effects of harsh economic environment and climate variability have impacted heavily on the rural poor in Muzarabani. Expenditure on household food sharply increased. On the other end, the community had to trade their livestock at comparatively low prices whilst food prices remained high. That required supplementary sources of income to make up for the high costs. The majority of the households (95%) revealed that they depended on rain-fed agriculture to grow cotton, maize and other drought-tolerant crops like sorghum. However, their yields had been dwindling over the years due to alternating episodes of drought and floods in the area hence, the total seasonal harvest (9%). The unreliable and ever failing crop yields made the Dambakurima community gradually reliant on eco-based food and income sources such as *Zm* trading. This explains why the contribution of wild fruits (12%) to household food income was relatively higher than that of the seasonal harvest Figure 4.1.

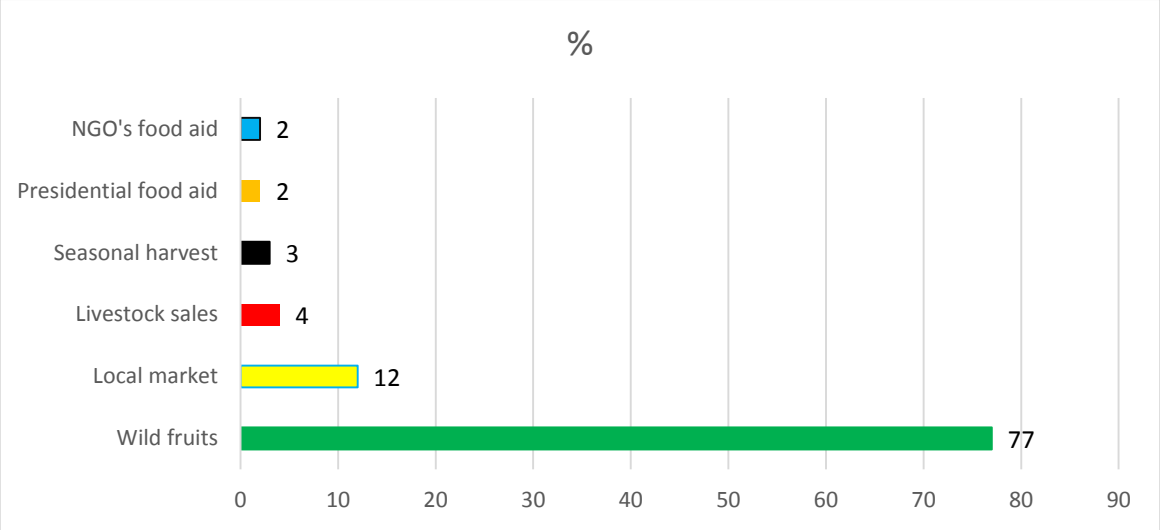


Figure 4. 2: Immediate Adaptive strategy against flood or drought

Source: Field-based material. (2016)

Further analysis of the diverse immediate adaptive strategies employed on contribution to household food after drought or floods revealed a different result as shown in Figure 4.2. Wild fruits (77%) provided the highest significant immediate contribution to household food after an extreme weather event at the study site. Reasons for this explanation are twofold; *Zm,* in particular, was readily available, cheap and provided services that contribute to household food when needed throughout the year. Secondly, other strategies were too remote a solution to immediately fall-back on, for example, NGOs food aid or the Presidential Food Aid took long before assisting or contributing to household food basket in Dambakurima. Reasons for the delay included distance, inaccessibility and bureaucracy. Hence, the two strategies (NGOs food aid and the Presidential Food Aid) ranked the last two with (2%) apiece. In the middle of the pack, seasonal harvest and livestock sales both contributed lowly (3% and 4% respectively) since all were directly affected by adverse weather conditions. Notably, the strategy of using the local market to access household food was ranked the second from the top with (12%). The results r from the study showed that the majority households (74%) made use of the money sourced from the sale of *Zm* or *Kachasu* — an alcoholic beverage made out of *Zm*. It was noted from the results that there was a tendency for diversification to less rainfall-reliant sources of household income as is the norm for rural farmers in many countries and this view was supported also by Kiem & Austin (2013). In support of the above view some household respondents had this to say;

> "If we had no *masau* in this area we could be worse off. Imagine what would happen to the households that depend on *Kachasu* brewing and those that sell dried and fresh masau to get money for food and school fees. That evergreen tree (*Zm*) you see over there means life here in Dambakurima. This tree is our immediate fall back source of food each time things go wrong in terms of the weather. *Masau* will always help us feed our families before any external actor comes in. Moreover, they (external actors) take their time whilst we suffer, we cannot wait for that."
>
> (Pers.com, 2016e).

> "Non-alcoholic and alcoholic beverages all come from *masau* so everyone in the household is catered for both the young and adults during periods of environmental stress."
>
> (Pers.com, 2016f).

Interview results indicated that 96% of the households produced drought-tolerant local cultivars such as cotton, sorghum, rapoko and pearl millet. In response to unreliable erratic rainfall impacts, different agricultural spaces were utilised to grow crops and vegetables, spaces like dambos (matimba) to lessen the risk of total crop failure. It was evidenced by the responses that almost everyone grew drought-tolerant crops, however, the environmental immigrants for lack of experience in the area, preferred the traditional maize growing. This made these households the most vulnerable group in Dambakurima. Worst still, they did not own the *Zm* trees as other original ethnic groups from the area. A female respondent aged 60 years had this to say;

> "The weather has been very evil to us, though comparatively, we produce better yields than people who are not the original inhabitants; they are the most vulnerable because they don't grow drought-tolerant crops. In addition, their plight is worsened by the fact that very few of them own *Zm* which is our immediate source of income during floods or drought. You know even us who grow drought-tolerant crops we experience crop failure for long periods. There are periods as I have observed that those who gather *Zm* are better off in terms of annual household income than those who rely on rain-fed agriculture".
>
> (Pers.com, 2016g).

Linked to the above component was the need to identify the type of crops that the households grew in Dambakurima. This focus was vital in assessing the level to which the different crops equipped them to address climate variability challenges. Table 4.6 and Figure 4.3 show the different crops grown and how households interviewed cited them as the most preffered crops.

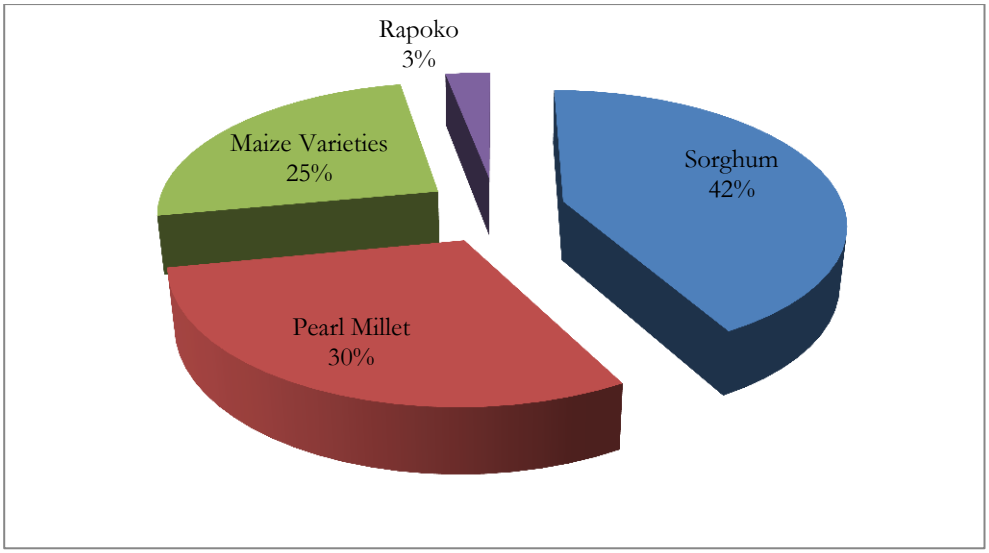


Figure 4. 3: Crops grown by households

Source: Field-based material (2016).

Cropped area varied greatly but almost every household had a piece of land under a drought-tolerant crop. Those with small land holdings of about an acre or less indicated preference for growing maize at the expense of drought-tolerant crops and were, therefore, more vulnerable in the event of a drought. The highest proportion (42%) of the households grew sorghum; 30% pearl millet; 25% maize varieties and 3% rapoko Figure 4.3. Interviews revealed that the households which grew drought-tolerant crops obtained higher yields as compared to those that grew maize.Besides the contribution of mentioned crops, the study further analysed the ontribution of *Zm* to household well being in Dambakurima. The Table 4.4 showed various contributions towards the welfare of the Dambakurima community.

Table 4.4: Contribution of *Ziziphus mauritiana* to household wellbeing in the study site

Type of use	No. citation	% citation	No. of 20 litre bucket gathered	Est. monetary value US$
Brewed for traditional beer	34	13	60	780
Sold for income generation	73	30	95	190
Food consumption	64	25	80	160
Traded for barter system	48	19	45	90
Brewed for traditional drink	34	13	25	50
Total	253	100	305	1360

Source: Field-based material (2017).

Respondents in the study revealed that *Zm* generates income and had the highest citation of 30%. *Zm* was also for consumption and was the second with 25% citations. Traditional beer *kachasu* and traditional drink *gununzvi* from *masau* had the least citations each with 13%. However, it was worth noting that *Zm* used for brewing beer had the highest estimated monetary value of 780USD$ for 60 buckets. This is explained by the risky connotations attached to the exercise of brewing and marketing of *Zm.* A woman aged forty five who raised her family through selling *kachasu* had this to say;

> *"Kachasu* brewing is a risky business with high returns. You know it is an illegal business venture here in Zimbabwe. However, economic returns from *kachasu* are too high. Imagine a bucket of *masau* can brew *kachasu* worth 14USD$, yet a bucket of *masau* is sold for only 2USD$ to the middlemenfrom different parts of the country."
>
> (Pers.com, 2016h)

In support of the above view a widow aged fifty-five said;

> "I have sent all my 4 children to a nearby boarding school using money from *Kachasu*. We brew *Kachasu* throughout the year using dried masau that means I get income throughout the year. *Zm* means life to me and ithas played a pivotal role during harsh environmental times."(
>
> (Pers.com, 2016i).

4.3 Percentage monthly *Zm* products contribution to household incomes.

The percentage support of *Zm* to monthly household incomes is presented below. The result shows that 48% of the respondent's households got between 25.51% and 45.5% of their monthly total income from *Zm* products while 21% fell within the range 45.51% and 65.5% of their sum household incomes from the sales of *Zm* fruits. Meanwhile, only 2% of all the household respondents raised more than 85.5% of their income from *Zm*- based initiatives in the village studied. *Ziziphus mauritiana* fruits when dry can also be traded throughout the year. However the pattern of sales is high in August and low in January. The monthly income during peak months the study established was well above the poverty datum line pegged at $1.25 per day (World Bank). This finding infers that *Zm* constitutes a key constituent of the Dambakurima's semi-arid rural homes' economy since they account for 1/3 of the entire households' income in Dambakurima village.

Having established the importance of *Zm* to the livelihood of the Dambakurima community it was imperative to map diverse actors that are linked or at least who had the interest to promote resilience in this particular community. Figure 4.4 maps, vital actors/institutions that facilitate or promote resilience andadaptation strategy in extreme weather conditions in Dambakurima. A complex web of interaction is shown linking the actors from bigger and smaller circles. The bigger sized circle represented the more resilience facilitating role the actor played. In contrast, the small sized circle showed the less facilitating role the actor assumed according to the respondents from Dambakurima. The Dambakurima community and the (non-human actor) *Zm* were shown in big inter-connected circles. The respondents rated the two circles as the more facilitating actors compared to any of the circle in the Dambakurima resilience community circle. The Dambakurima community as the most affected actor during floods or drought does not take a passive role. The community looks around for immediate fallbacks and *Zm* was identified by the respondents as the eco-resource that is an immediate fallback at their disposal. The respondents further cited the President's Office as the most important actor and are shown in a big circle.However, though highly respected the President's Office was placed outside the resilience circle in the Dambakurima community. Subsequently, the President's Office was regarded by respondents as almost invisible in their community. For the reason stated above the president's office was rated as less facilitating actor. These sentiments were also expressed by a widow aged fifty-five who said:

> "The president office is highly respected here, however, in terms of their visibility and contribution to building resilience, I would rate them as less facilitating. The main reason for my rating is based on the fact that we only see representatives of this office during election periods, yet we experience alternating hazards (floods and drought) almost annually."
>
> (Pers.com, 2016i).

In support a female respondent aged 60 had this to say:

> "We acknowledge the president office as an important institution. It is this office represented by different actors like Environmental Management Agency (EMA and Muzarabani Rural District Council (MRDC), so it's difficult to draw the lines. However, according to my own assessment, the office isnot visible here. The non-governmental organisations like Red Cross, the Dambakurima community, and its eco-resource like *Zm* are more facilitating actors in the resilience discourse."
>
> (Pers.com, 2016g)

The state organs though under the president's office actors were rated differently. The MRDC, EMA and the Civil Protection (CPU) had almost equal circles and were ranked as the most visible actors from government institutions providing relief support to victims of weather stresses. Their rating was more or less facilitating. CPU was considered as the most visible actor of the three organs during times of drought or floods, yet, repondents raised concern over their unsustainable intervention efforts given only after the hazard. However, in terms of facilitating the production of *Zm*, EMA was rated as the most facilitating actor in the promotion of *Zm* production as a resilient option. The NGOs were identified by a bigger circle than the government organs. The results showed that NGOs were less facilitating in the production of *Zm* and advocating the wild fruit tree as a livelihood alternative strategy. However, the respondents reported that NGOs were visible and important actors that provided food relief in Dambakuurima during times of floods and drought. Hence their rating was more or less facilitating in promoting resilience efforts. The church and the Dambakurima neighbouring community were the nearest actors of Dambakurima community network in terms of physical distance. However, they are shown in the smallest circle which means they are regarded as the least facilitating actors of an eco-based resilience option. Figure 4.4 shows that an actor may be near, but remotely connected to the ideas or concerns of the community in question. An example is that of the church or the Dambakurima neighbouring community and the state organs like EMA, the latter is doing more in facilitating the use of *Zm*, yet it is a distance from the study site compared to the church (Figure 4.4). In context, the state or President's office seems very far in terms of distance and less visible according to the respondents.However, a closer analysis shows that the connections between the president, s office and various state organs such as MRDC make it connected to the Dambakurima community in the end. The striking point of the study results was shown by the small circle size representing the higher education institutions. The respondents revealed that researchers were non-existent and have facilitated nothing in terms of resilience discourse. Hence they rated higher education as less facilitating actors in enhancing resilience through alternative means.

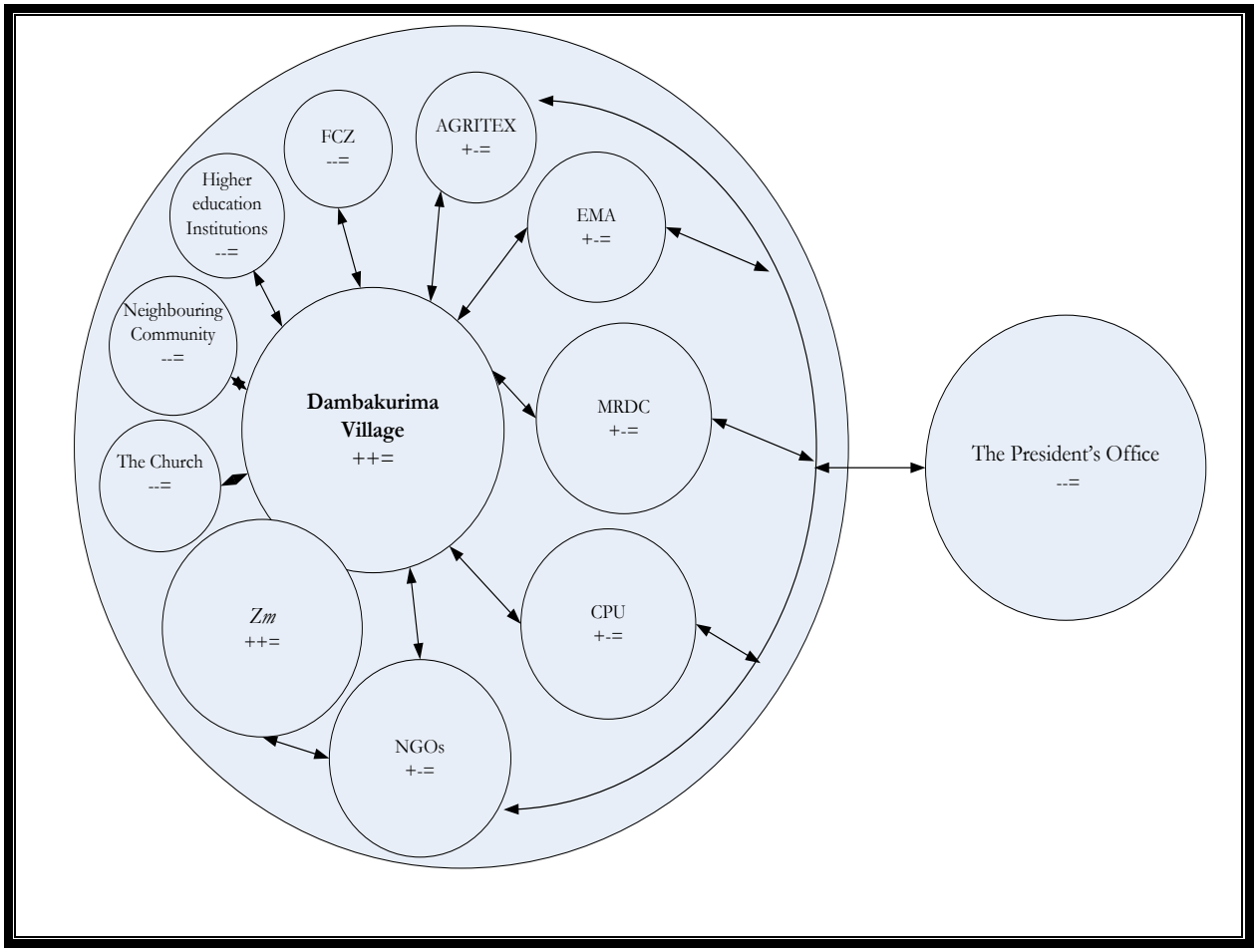


Figure 4. 4: Mapping of vital actors/institution for facilitating *Zm* as an optional adaptation strategy to extreme weather conditions

Source: Field-based material (2017).

Key: ++= more facilitating actors EMA=Environental Management Agency

--= less facilitating and FCZ= Forest Commision of Zimbabwe

+-= More and less facilitating CPU=Civil Protection Unit

Zm=*Ziziphus mauritiana*AGRITEX=Agricultural Technical and Extension Services

MRDC= Muzarabani Rural District Council NGOs-Non Governmental Organisations

Table 4.5 shows that factors influencing the decision to participate in *Zm* production or support as an alternative adaptive approach are many and complex and these included lack of coordination ofthe diverse actors, prevalence of natural resource conflicts, persistent poverty and lack of political will/ support.

Table 4.5: Factors influencing actor's participation in taking *Zm* as an alternative livelihood source from focus group discussion

Factor	Number of respondents	Percentage %
Lack of coordinated or networked approach	24	34
Natural resource conflicts	19	27
Lack of diverse actors' participation	14	20
Persistent poverty in Muzarabani	8	11
Lack of political will/ support	4	6
Lack of research and technical support	1	1
TOTAL	70	100

Source: Field-based material (2016)

The numbers of respondents shown in Table 4.5 are not the same with those from other tables mainly because the study made use of the snowballing technique, which entails one respondent referring to another. Hence, the number of respondents varied from one table to the other. Thirty four percent of the participants from the Dambakurima village identified lack of coordinated or networked approach as the main factor influencing diverse actor's participation in *Zm* production. Followed by natural resource-based conflicts factors (27%). It is vital to note that lack of diverse actor's participation towards eco-based resilience approach was identified as the third, and represented (20%).

Although lack of coordinated or networked approach by diverse actors such as the local community, Forestry Commission of Zimbabwe (FCZ), Muzarabani Rural District Council (MRDC) and Environmental Management Agency (EMA) appear to be the main factor influencing the respondents from the Dambakurima households to support the idea of having *Zm* as a livelihood or resilience option, it should be emphasised that lack of research and technical support though given the least percentage (1%) inthe Table 4.5 it can influence policy makers to promote *Zm* production in Dambakurima.

The lack of political will has been blamed by (6%) of the respondents who suggested weak legislation was due to non-commitment of the authorities to consider *Zm* in policy issues, hence, threatening its sustainability. An official from one non-governmental organisation echoed the same sentiments. He argued that the inability by government policy makers to seriously include *Zm* or other wild fruits in policy planning was because of lack of knowledge, political will, and ineffective euro-centric approaches to natural resources management. The same respondent also blamed the unstable economic situation in Zimbabwe. However, the government officials refuted the claim saying there was more to it than the economic situation. There is therefore need to understand different actors in order to put eco-resources into resilience perspectives. In addition, ineffective and week state institutions, with absence of political will play an important negative role in sidelining the great potential of eco-resources based resilience or local food aid initiatives in semi-arid spaces. In the same vein, responsible authorities from the Forestry Commission of Zimbabwe (FCZ) acknowledged the fact that shortage of manpower and poor coordination hampered government effort to effectively incorporate indigenous plants into fully fledged programmes that benefit the poor.

Absence of research and well documented information about the importance of wild fruits under climate changeremains a cause for concern to many government officials. Most key informants (64%) suggested Climate Change (CC) as the greatest threat to the sustainability of *Zm*. From one non-governmental official's perspective, CC has not only threatened the existence of *Zm* but, has also caused loss of human and animal life. Although *Zm* is known to be drought tolerant, continued stress from adverse conditions will eventually affect its existence. More so, if people are left with no alternative in the drought-prone areas they will put more pressure on existing *Zm* or eco-resources. This calls for a concerted effort by all actors whether human or non-human.

The observation made revealed that the daily managers of *Zm* in Muzarabani included women, men and children. (60%) percent of the respondents (mainly females) were of the view that poverty was the main threat to the sustainability of *Zm*. They argued that poverty in patriarchal systems puts women under pressure to provide food. Since *Zm* is their immediate fall back during drought or flood period, they unfortunately extend their pressure on it in search of food. The study revealed that the level of food insecurity was extremely high. In Dambakurima (97%) of the respondents suffered from some form of food insecurity. Unreliable erratic rainfall has fuelled the poverty of these rural people. However, the diversified life styles by the Dambakurima community, together with their different social structures have to some extent contributed to their core economy based on rain-fed agriculture. Those who are poor provide labour and in turn get food or cash that keeps them going even during hard times. However, the absence of well-coordinated structures that act as voices for the poor is a challenge. The rural poor in Dambakurima remain disjointed, and living in the arguably the remotest part of Zimbabwe makes them isolated from other actors who can make a change in their lives. Vulnerability of these rural communities can only be improved if networks that build their own resilience are improved. To understand the existing institutional arrangements the study in the next part of the chapter explored Actors and institutional arrangements governing *Zm* utilisation and conservation in Dambakurima.

4.4 Actors and institutional arrangements governing *Zm* utilisation and conservation in Dambakurima.

4.4.1 *Ziziphus mauritiana (Zm)* ownership

Observed in the study were variations on the views of households concerning the ownership of *Zm* under the background of the communal tenure system. Seventy two point three percent of the households and 90.1% of the youth between 18-35 years were of the view that *Zm* trees were owned by the locals. Hence, individuals claimed ownership of specific *Zm* found in their fields, homesteads and even in the wild. The perceptions of most local people contradicted the standing legal stance in Zimbabwe that the wild fruits or eco-resources in rural spaces belong to the government. This reflects the confusion surrounding ownership and user rights by the locals in Dambakurima. Lack of knowledge by the natives of the specification of the communal resource/s tenure system that grants the local populace user rights only has been blamed on the government's failure to give details to the community. Hence, the perceptions of *Zm* ownership rights have been characterised by confusion. The study established from key informants that because of the confusion some local people often resist or ignore advice about eco-based

conservation. In addition, some perceive it as an uncalled for intervention by external actors on the resource given to them by God.

The absence of clarity to the local people on the specifications of communal tenure, resonate well with findings in Zimbabwe where inadequately addressed properly rights are linked to mal-practices and unsustainable utilisation of natural resources (environmental evils) by (Marambanyika, 2015; Mubaya &Mafongoya, 2017). Therefore, for the communities to benefit sustainably from the *Zm*, there is need to give clear ownership to the natives. This will also benefit the people as well as the environment. Currently, the concept of decentralisation where the government organisations or the rural district council authorities uphold natural resources or the *Zm* in place for the people is a mess with uncertainty; a view shared by (Mubaya &Mafongoya 2017).The whole management process of the *Zm* involves several institutions or actors. This encompasses native institutions run by traditional elders and leaders and outside institutions such as NGOs, local authorities and the agencies from central government.

Table 4.6: Views held by households about *Zm* ownership measured by various institutions responses in Dambakurima village

Institution/ Actor	Frequency	%
Traditional healers	82	22.1
Political leaders	12	28.6
Local people	16	59.1
MRDC	....	....
State	10	24.1
God	2	6.1
Not sure	....	....
Don't know	4	15.2

Source: Field-based material (2017).

The majority of household heads (83%) claimed that institutions were clear in terms of their roles and mandates, although results from many organisation officials interviewed revealed that the number, purpose and importance of various institutions were not the same. Different institutions had diverse mandates and preferences which in turn influenced the way they participated in *Zm* production and management activities. Some of the institutional priorities were at a crossroadswith environment and socio-economic benefits. Therefore, in ANT terms

Rapp (2017) and Wessells (2007) argue that where interactions are complex, involving different actors, nework strategies are required for effective and efficient management of *Zm*. The following part of this chapter explores the extent to which this is being upheld in Dambakurima village of Muzarabani District, Zimbabwe. The Figure 4.5 shows actors and the complex ineractions that charecterise the use and management of *Zm* in Muzarabani.

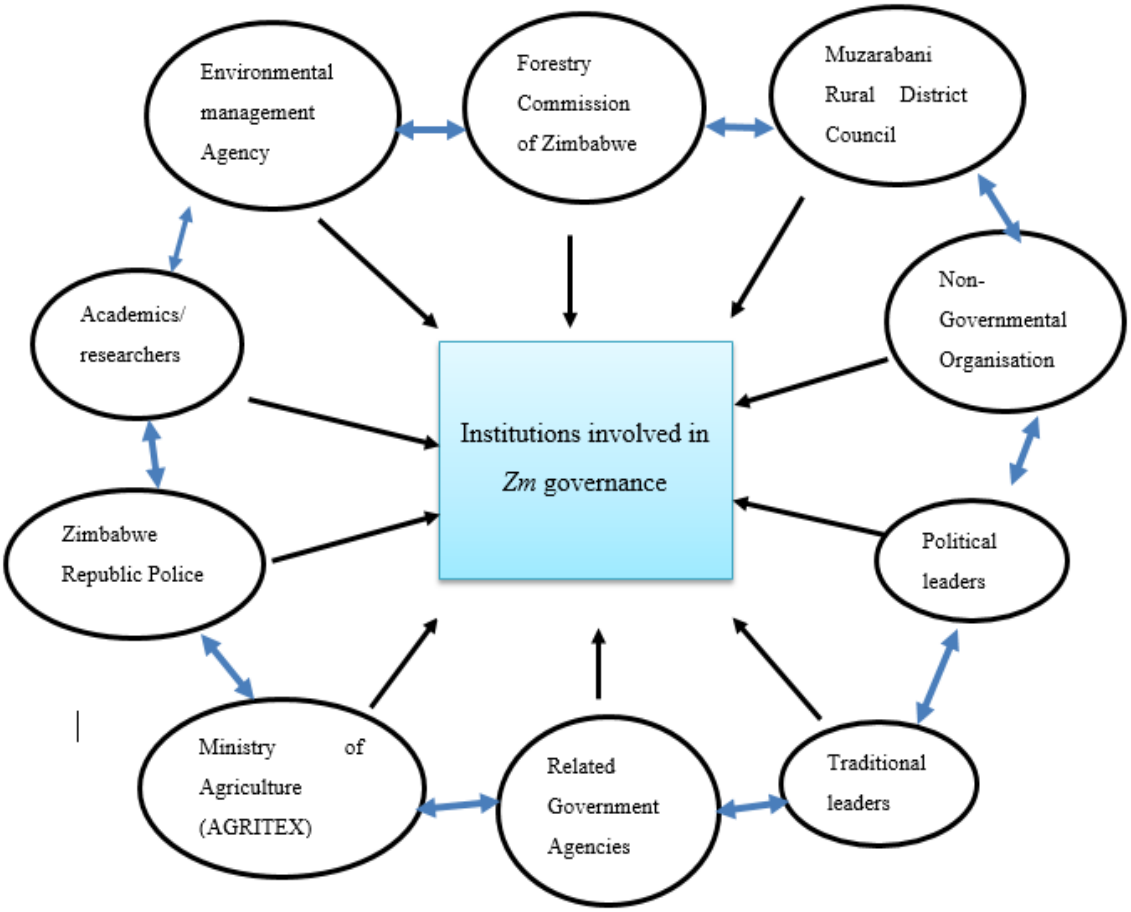


Figure 4. 5: Institutions or actors involved in the management of *Zm* in Muzarabani

Source: Field-based material.

4.4.2 Access and utilisation of *Zm* roles and responsibilities by diverse institutions.

Spatial-temporal differences were reflected in reference to the contribution of identified institutions in controlling access and utilisation of the *Zm*. The majority of households (72%) regarded the traditional leaders as the most visible and active actors in allocating *Zm* trees and ensuring that conflicts related to *Zm* access and use are minimised. In the same vein, Agritex gives advice and assists in the operating of NGOs such as SAFIRE and Red Cross in their Agro forest-based projects. The study, however, noted that though Agritex is visible in the study area, there are no specific projects or tasks that they have implemented to help communities access, manage or utilise *Zm*. SAFIRE, is considered to be the only institution that has made efforts to promote the production of *Zm* in Muzarabani at some point (2002).

> "As far as I can recall SAFIRE is the only institution that gave us support to produce *Zm*. They gave us input such as *Zm* seeds, hoes and knowledge". (Pers.com, 2017a).

> "Yes SAFIRE did their part fifteen years ago but they were treated with suspicion by theselocal politicians and the project did not go anywhere".

(Pers.com, 2017b).

According to information gathered from the traditional leaders, SAFIRE in alliance with Agritex and FCZ promoted *Zm* utilisation by providing capacity building workshops on *Zm* production. Although at the time, the presence of each institution was rated differently; all confirmed their participation at different levels. Table 4.7 shows how the local key informants interviewed rated the participation of the identified institutions to the SAFIRE project.

Table 4.7: Participation of the identified institutions to the SAFIRE project (local key informants view)

Institution	Excellent	Very good	Good	Poor
SAFIRE	✓			
MRDC				✓
Forestry commission			✓	
Traditional leaders		✓		
Political leaders				✓
AGRITEX		✓		

Source: Field-based data material (2017).

Political leaders were ranked the least with their rating denoted as extremely poor in the participation of the *Zm* project by SAFIRE. FCZ's participation was rated good, though their presence and contribution were questioned by some respondents. However, key respondents from FCZ and EMA had this to say;

> "We were aware of the SAFIRE project and approved it, but we could not always be there, we do not have an officer operating in the Dambakurima area. We are

short staffed so we rely on information conveyed to us by AGRITEX, we work together".

(Pers.com, 2017c).

"EMA was not yet in existence there was the Natural Resource Board so I can't say muchbecause we were not part of the arrangement. Though I acknowledge such initiativesneeds to be supported"

. (Pers.com, 2017d).

In a nutshell, the participation of the institutions in *Zm* production, access and utilisation are not uniform as shown in Table 4.8. However, it must be noted that other NGOs like the Red Cross, though they isnot visible in the efforts and *Zm* production, promote various livelihood activities that include agriculture and keeping of small domesticated animals like goats.

Table 4.8: Household views on institutional involvelment in *Zm* access and utilisation in Dambakurima village

Institution	Frequency	%
SAFIRE	61	50
Other NGOs	8	6
Traditional leader	86	70
Political leaders	16	12
FC	3	20
EMA	22	1
AGRITEX	44	36
Local people	2	1.0
Eco-resource committee	9	7.0
MRDC	21	17

Source: Field-based material (2017).**N=124**

Only 18.2% of the key informants revealed that EMA regulated access to natural resource utilisation which included wild fruit trees like *Zm*. This view was anchored on the premise that EMA was mandated to ensure sustainable environmental management and use. Evidence from the EMA officials and from their sister organisation FCZ pointed to the fact that it was very difficult and almost impossible for them to monitor the allocation and use of *Zm*, though they acknowledged its importance. Those statutes gave the local communities the right to use the resources for their own benefits.

This scenario concurs with Cimon *et al.,* (2013)'s study in which it was revealed that most countries in sub-Saharan African do not fully support wild fruit utilisation, management and development, in spite of their undisputed role in resilience and livelihood security during times of natural hazards. However, a study by Mubaya & Mafongoya (2017) testifies that the utilisation of eco-resources, such as wild fruit, without the state's regulation ends in pronounced resource degradation. It is against this background, that this study argues that the continued use of *Zm* without clear environmental considerations may well be a threat to the wise idea of using *Zm* as a resilience option in Dambakurima.

Furthermore, institutions such as the state, local authorities and NGOs claimed that politics was a handicap in monitoring and effecting rules and regulations that protect *Zm*. This was mainly because rural communities like the Dambakurima village turned to these wild fruits in times of need, and they had become the source of their basic livelihoods. Politicians normally are interested in popularity agenda's; hence, paid little focus on environment agendas. Politicians made some questionable comments about *Zm,* for example, one said;

"Zm is all yours; you can do whatever you want with it. Our ancestors gave us that tree as our only source of livelihood."

(Pers.com, 2017e).

The words, if carefully analysed, denote some careless and mischievous connotations. One would take words like "you can do whatever you want with *Zm*" to mean you can cut down the tree for firewood; you can sell the firewood or carry out any other destructive activities.It was a common scene observed, in the research, to see a councillor sanctioning the harvesting of *Zm* to external actors behind the back of other villagers. This was breaching the law that stipulated that the resource should only be accessed by the locals and the benefit should be for the locals. That led to unsustainable harvesting methods in some parts of Dambakurima. The *Zm,* according to one elder interviewed, is the most preserved wild fruit tree in Muzarabani, and it should not be disturbed by the activities of men, such as cutting it down, over-harvesting or early harvesting since it is a sacred source of survival for locals in times of drought or floods.

Of late, environmental committees, elected by the local beneficiaries of *Zm,* were responsible for the day-to-day management of the resource as outlined by 74% of the respondents. Though they were new actors their participation in terms of *Zm* use and access was considered poor by 30% of household heads. These localised committees acted as watchdogs for other institutions such as EMA, FCZ and the ZRP. It was within their power to determine when the harvesting of *Zm* should start, who should be directly linked to an external actor such as a trader, what price should be charged and who should and should not trade with the community. However, they did

this in consultation with their traditional leaders and EMA. Evidence from the study revealed that there was poor coordination between these different institutions.

> "There is a new environmental committee but to be honest with you they do not work wellwith the traditional leaders or even the EMA and the police. To other institutions, they are just a bundle of the overzealous activists who think they have the power to disregard the elders' opinions about*Zm*."
>
> Pers.com, 2017f).

This explains why 94% of the households said there were serious misunderstandings and discord regarding the governance and regulation of *Zm* access and utilisation; a scenario that put unnecessary pressure on *Zm* as an eco-resource, made worse by the ever-increasing population of Dambakurima.

4.4.3 **The role of various institutions in *Zm* management and conservation**

FCZ, EMA, MRDC and traditional leaders are the focal actors influencing policy path on *Zm* management and conservation, even though other actors such as Agritex, NGOs and other government departments offered marginal, but significant roles in the Muzarabani case (Table. 4.9). The institution known to be effective in implementing environmentally related strategies in Dambakurima was EMA. However, 44% of the respondent agreed that EMA was an invisible actor in terms of spearheading *Zm* projects and monitoring the use and management of the species. EMA was only visible when it came to penalising offenders. Traditional leaders and local leaders monitor *Zm* use by checking the compliance of by-laws and punishing offenders. The traditional leaders were confirmed as the most effective institution. This could be linked to their day-to-day interaction with the community and the social mutual respect attached to elders of the land in Dambakurima.

Table 4.9: Household views on the different institution`s influence in *Zm* management and conservation policy decisions (as evidenced by responses to the survey carried out)

Institution	Frequency	%
Traditional leaders	29	42.1
MRDC	8	11.6
Councillor	10	14.6
Environmental committee	14	20.1
EMA	28	31
FCZ	8	11.2
Agritex	2	3.2
NGO	5	7.6
Research institutions	2	3.0

Source: Field-based material (2017).

One organisation, which has a mandate to ensure sustainable utilisation and management of wild fruits, is the FCZ. However, FCZ's main activities were monitoring of the spatial distribution of trees and vegetation cover. The respondents from households acknowledged that if each institution could meet its expectation, enhanced protection against natural resources could be achieved. The conservation effort of FCZ was critical as it guaranteed or at least contributed to the sustainable utilisation of *Zm*. The councillor, who was also a political actor, played a crucial role in monitoring environmental evils such as the over-harvesting of *Zm* in Dambakurima. The councillor was also responsible for coordinating meetings and workshops initiated by NGOs and government organisations on the sustainable utilisation of *Zm*.

Agritex and researchers from institutes of higher learning provided non-monetary resources like research and fences for prevention of attacks on the fields by both domestic and wild animals. Given the fact that *Zm* spaces included the fields and gardens that rendered an indirect role in the conservation of the fruit tree in question, unfenced gardens and fields with *Zm* were prone to human and animal disturbances, as reported by 15% of the household heads. Therefore, it was necessary for *Zm* producers to fence their fields to prevent yield losses and damage to *Zm* by animals.

Environmental committees, with the *Zm* producers and other locals, effected a citizen arrest on environmental offender, handing them over to responsible government officials. Some illegal activities that disturbed the conservation of *Zm* included cutting down trees, over-harvesting of *Zm*, harvesting illegally at night, indiscriminate harvesting and any unsustainable *Zm* use and management activities. Poor inter-linkages and coordination by various aligned actors were perceived by 88.3% of the *Zm* producers to be the main reason for the current deplorable state of *Zm* in Dambakurima. However, 32% of the farmers in Dambakurima acknowledged the importance of the environmental committees in imparting knowledge and coordinating activities for improved *Zm* conservation.

The role of environmental committees in coordinating the natural management of resources and the spatial-temporal differences in their execution of duty was acknowledged in Kenya by Quandt *et al.,* (2017). The capability of diverse actions or institutions to help *Zm* producers utilise it as a resilience and livelihood option rests upon the conservation strategies employed. However, the promotion of *Zm* conservation, by the mentioned institutions, depended on daily networks rather than the specific institutions such as EMA, FCZ, MRDC or NGOs. The above statement explains the frequency level of each institution as shown in Table 4.9. EMA and FCZ were identified as reactive actors in the use and management of *Zm* because of the low frequency of their visits to Dambakurima as indicated by 62% of the household heads. Occasionally, EMA and FCZ responded to *Zm* degradation and potential threats/hazards such as fire (natural or man-made) rather than a programmed environmental routine management of eco-resources. MRDC has a department responsible for the environment; their presence was considered negligible by respondents. Hence, the participation of local authorities and government organisations remained low and largely unknown. In another case study in Zambia by Kalaba (2007) confirmed that poor participation by state organisations was a common problem which derailed efforts at ecological conservation.

Inadequate resources, both financial and human, were also identified with key information pointing to theconstrains at FCZ, EMA and MRD hindering proper functioning. Agritex, in contrast, was viewed to be the most visible actor. This could be explained by the fact that of all the government departments it was the only department that had officials living with members of the community. In addition, Agritex was involved in Agroforestry and was actively involved in promoting resilience and securing food in semi-arid spaces.

Political leaders were very rare in terms of presence in matters to do with the use, access and ownership of *Zm* in Dambakurima. The presence of NGOs in natural resources management was only felt when SAFIRE had the power and education programmes to further *Zm* development. For reasons that were beyond NGOs operating in a volatile economic situation, SAFIRE withdrew its operations. The *Zm* degradation was witnessed soon after the withdrawal of SAFIRE in the study site said one traditional leader. This was as a result of mismanagement of the resource by the local people as the population increased. Mismanagement was also indicated by 12% of the households. In summary, the following institutions were frequently involved in *Zm* management and effective conservation; FCZ, EMA, and MRDC.The involvement of government departments was poor. This was in contrast with observations made byMorzaria-Luna, *etal*.,(2013) that the frequencies of visits by mandated institutions demonstrate a sense of stewardship by the local people to be involved in the local natural resource management. This

entails the need for various concerned institutions to undertake active responsibilities for *Zm* (natural resources management).

4.4.4 **Actor networks among diverse management institutions**

Natural resource management is effective when involved actors are identified and their networks are established. The relationships that exist between institutions are vital for the benefit of the natural resource available and this claim was echoed by 86% of the household heads. Good progressive relationships ensure that potential conflicts are avoided. The involvement of diverse actors in the management of wild fruits such as *Zm* triggers complementary, but at times contradicting roles. The MRDC, though not very visible, as suggested by some respondents, acknowledged Zimbabwe Republic Police (ZRP) presence whenever they wanted to carry out natural resource programmes on the study site. These organisations normally pooled their resources together to ensure that the programmes were a success, said one of the key informants from MRDC. However, in a few instances these institutions did not work together in *Zm* production programmes organised by SAFIRE, illegal environmental cases were recorded by some key informants from ZRP to be low.

MRDC sanctioned and monitored activities of *Zm* users and beneficiaries in Muzarabani District and these included traders and non-governmental organisations involved in *Zm* activities. All actors who wanted to transport *Zm* from the district were supposed to pay a levy to the MRDC. However, some traders and NGOs deviated from this by engaging in unsustainable *Zm* use; thereby compromising the ecology of *Zm*. Forty percent of the households blamed the MRDC for having corrupt officials who were not consistent and transparent when dealing with *Zm* traders. However, key informants from MRDC blamed the inconsistence on lack of human and capital resources to effectively monitor all *Zm* transactions in the district. This scenario often led to conflicts between the locals, traders and MRDC as confirmed by 61% of the household heads. The situation normally resulted in traders or mediators benefiting from *Zm* more than the locals. Some villagers, through frustrations, withdrew their participation in *Zm* conservation efforts. However, in some parts of the village where there was coordination among the various institutions mentioned above, *Zm* production and conservation was reported to be extremely good, and the locals benefited from high yields of *Zm (Masau*).

> "You know that area down there is called *Kumasau,* people there year in, year out have the highest yields in the village. Some attribute that to the mutual relationship they have with MRDC, EMA, Agritex and non-governmental organisations. They are good listeners and implementers of the rules of the *Zm* game. Here it is a bit different; there are too many people from other ethnic backgrounds, and most of them do not co-operate. Hence there are poor *Zm* yields. The identified institutions have, in most cases, the same livelihoods and food security agendas for the locals. It is, therefore, logical for these institutions to network and foster good relations with the locals to achieve their goals."
>
> (Pers.com, 2017g).

Agritex is the better-staffed institution in rural areas. However, their efforts are recognised less by other institutions that operate in Dambakurima; for example, NGOs

like SAFIRE. A key informant from Agritex, as an example, stated that they did not participate in the project initiated by SAFIRE because they were not informed or invited, yet their work revolves around the improvement of agricultural and forestry products. The key respondent further suggested that because of lack of trust and networking, the SAFIRE project died a natural death. However, it was acknowledged by the MRDC officials that future projects would incorporate almost every institution to ensure the sustainable management and utilisation of the natural resource in question.

Networks and relations among the environmental committees, the local political leadership and EMA were sometimes unfavourably disposed to natural conservation efforts. This is seen especially where political institutions took everyone for granted and made decisions detrimental to the environment. However, the formation of the environmental committees in Dambakurima saw the situation improving, as it presented a platform for all institutions to meet and discuss environmental concerns, including *Zm* management. However, the implementations of the agreed deliberations were poor, mainly because of the divergent interests of various institutions. Conflicting roles were encountered, for example the MRDC had the role to ensure sustainable livelihoods and environmental protection, which slightly differed from EMA's position of mainly focusing on environmental protection. That, in turn, resulted in institutions clashing in their priorities.

4.4.5 The role of the local *Zm* producer in role in *Zm* management and conservation

The majority of households (86.2%) acknowledged their involvement in *Zm* conservation, though their levels of participation varied. The main activities that the households undertook included pruning (84%), weeding (68%), fencing (60%), protection of *Zm* from animals (wild and domestic) (70%) and the practice of conservation farming and fireguard construction.

The research further established that the original inhabitants of the area (*Vakorekore)* have more *Zm* trees which are nearer their homesteads and fields and tend to participate more in the conservation of the *Zm* than the other minority ethnic groups.

> "We are the original inhabitants of Dambakurima. We own most of the *Zm*, we know its importance especially during drought and flood period we experience. Hence we take care of the *Zm* more than anyone in this village."
>
> (Pers.com, 2017h)

This shows that people who live close to the fields and have homesteads where *Zm* is found are more actively involved in the conservation of *Zm*. Another argument could be that the *Zm* producers have a long history with *Zm* and fully understand the benefits they derive from *Zm* during adverse climatic conditions; hence, this leads to the conservation of *Zm*. The study revealed that there was no significant difference in participation between males and females, since all benefited as households. Of particular concern is the contribution and self-confidence of the youths who hold the perspective to become forceful instruments of resilience and development within the community. The culture of solidarity and unity, for example, has become a common feature that is missing in these rural places, disenabling natural resources

management efforts. Of the household heads interviewed, 80.2% expressed their concern over the low number of youths involved in the conservation of natural resources.

> "The youth thinks it is the elderly people's business to work and look after the *Zm*. They don't know the potential benefits that *Zm* and other natural resources have for their livelihood."
>
> (Pers.com, 2017i)

Thus, the history of the *Zm*, age, information dissemination, natural resource benefits and research should be taken into account when planning for *Zm* management and conservation. These factors mentioned above should also be considered because they influence participation in resource conservation.

Plates 4.1 to 4.3 shows evidence by some members of the Dambakurima village of environmental evils (deforestation) cutting down on *Zm* trees that could lead to the extinction of the promising fruit tree species.



Plate 4.1: *Ziziphus mauritiana* tree destroyed by a recently settled villager in Damabakurima

Source: photo by aurthor, 2016

The researcher embarked on a tour of the Dambakurima to areas that had more concentration of the *Zm* trees. Observations made are discussed below.

There was rampant cutting down of *Ziziphus maurittiana* see plates 4.1, 4.2, 4.3 and other fruit trees in many of the areas that were visited. Even though there were regulations that prohibited people from cutting down trees, people were still cutting the trees down. The images shown

below indicate the extent of the problem. Those interviewed about the causes of that environmental destruction specifically the *Zm* responses varied and the se included;

i. There was population growth in the area; hence people were competing for the few available resources.

ii. New homesteads were being created in the area to cater for children who would have married and started their own families as well as new comers to the area who are given pieces of land for farming and shelter by the local traditional leaders.

iii. The creation of these fields and homesteads was also contributing to the rampant cutting down of trees including wild fruit trees.

iv. Very few youths valued *Zm* and other wild fruits

This state of affairs revelead above has led to the further dwindling of the *Zm* fruits in the areas

Images of *Zm* fruit trees cut down in the fields of the Dambakurima village are shown in Plates 4.2 and 4.3.



Plate 4.2: Images of *Zm* fruit trees cut down in the fields of the Dambakurima village

Source: photo by aurthor, 2016



Plate 4.3: Images of *Zm* fruit trees cut down near the grazing site of the Dambakurima village

Source: photo by aurthor, 2016

4.4.6 What does the existing institutional arrangement has to offer to the Dambakurima Village and *Zm*?

The regulation of *Zm* use, ownership and management by the available institutions has resulted in 68.1% of household heads indicating that they had benefited economically, socially and ecologically from *Zm*. The government, through the MRDC, councilor down to the environmental committees and traditional leaders, all play important roles in ensuring that *Zm* utilisation is of benefit at local levels. The prevailing situation, on paper, allows *Zm* users and producers to increase their yields and enhance their livelihood resilience. If all actors lived up to expectation, the high *Zm* yield and those from other natural resources would at least offer goods and services that could ensure the livelihoods and food security of the people of Dambakurima. Most of the households have derived benefits, such as paying school and hospital fees, and securing income, food and beverages, through the production of *Zm*.

This supports the idea of incorporating all institutions in natural resource conservation, as observed by Hodbod & Eakin (2015) and Ingram (2011). The current institutional framework of Muzarabani has improved relations between institutions that involve the traditional leadership, government and the non-governmental institutions, as they work toward the same goal (to some extent).

4.4.7 Opinions of institutions, challenges and opportunities in the management of *Zm* in Dambakurima.

Representatives of the various institutions interviewed presented their views on the major bottlenecks and opportunities in the development of *Zm* for the benefit of the Dambakurima

community. From the interviews, five challenges were aired by over three-quarters of the respondents, as reflected in Table 4.13.

I. In Dambakurima, institutional structures have limited acknowledgement of multi-perception values of different institutions.

II. The dominance of some institution over others.

III. Inadequate information, lack of leadership and experience.

IV. Research needs to match the finding opportunities.

V. The Muzarabani climate is not well understood in relation to *Zm* production and management, and the end results show unexpected challenges such as over harvesting and indiscriminative cutting down of trees.

Table 4.10: The perspective of key institutions to challenges on *Zm* production and governancein Dambakurima (out of 10 as the worst)

Challenges	Quantity
Limited acknowledgement of multi-perspective roles (poor networks and coordination)	7
Inadequate funds for research	7
Lack of coordination of local information leadership and experience	6
Population increases	5
Climate (extreme weather conditions; floods and drought)	5
Unemployment	3
Remoteness of Dambakurima makes it difficult for potential consumers and institutions to appreciate the importance of *Zm*	3
Poor findings from *Zm* projects	3
Individuality by some community members	2
Zm commodity chains unfavourable for producers	2
Country's economic crisis	1
Lack of research and useful knowledge	1
Institutional relationship	1
Failure of previous projects for example the SAFIRE project	1

Source: Field-based datamaterial.

In the same context, five main opportunities were discussed by three-quarters of the household respondents, as represented in Table 4.14.

I. Actor networks, being interactive platforms of the diverse institutions, make a difference in *Zm* management.

II. Identified knowledge gaps, research output and dissemination need to be explored.

III. Policy changes and standardisation.

IV. Knowledge from non-human actors, for example global good practices and networks, could render a strong foundation for enhancing and supporting *Zm* production.

V. *Zm* presents un-explored multiple values, with their many uses for rural resilience and development.

Table 4.11: Opportunities on *Ziziphus mauritiana* production and governance from the perspective of key institutions (quantities out of 12 denote the number of responses to the theme of their interview)

Opportunities	Qty
Multi-institutional perspectives on roles of different uses	6
Climate change, adaption and resilience focus from different actors	4
Commercial plantation of *Zm*	3
Zm commodity markets improvement	3
Incentivising *Zm* production	2
Specific economic benefits of *Zm* research	1
Knowledge gap filling, research output and dissemination	7
Global knowledge and networks can support the local Dambakurima case	6
Policy standardisation promotes the use of often neglected natural resources	5
Local good practices can stimulate interest	3
Political will drives policy development and implementation	3
There are various examples of developing and developing countries utilising *Zm* meaningfully, for example India, China, Chad, United States and Germany	3

Source: Field-based material (2017)

Multiple-views of challenges and opportunities in *Zm* development in Dambakurima were identified through the focus group discussions held, and Tables 4.11 to 4.14 shows the results. Seven main issues were identified from the focus group discussions. There were, however, some that had resemblance to the interview findings, and these are put in italics.

I. *Muzarabani climate and inadequate local situation specific research.*

II. *Ecological perspective and multi-actions perspective Zm uses from diverse institutions.*

III. *Financial constraints.*

IV. Lack of good practices examples and promoting regulatory framework or tools.

V. Dissemination of information and knowledge.

VI. Lack of mutual relationships of diverse actors.

Table 4.12: Eco-based challenges and opportunities in the *Zm* development in Muzarabani that were identified during the focus group discussions

Ecology challenges		Opportunities	
I.	*Muzarabani climate variability*	I.	Embraces the ecological perspective to increase resilience and livelihood.
II.	Significant donor syndrome (relying on donors) depending on imported seeds	II.	Using locally available eco-resources and other natural resources in applied research.
		III.	Significant research needed in the use and potential for *Zm.*
		IV.	Despite the local knowledge about *Zm* production, little is known about the potential of *Zm* by the various institutions that claim responsibility for the species. Zimbabwe participates in global forums for climate change and adaptation, for example the ecological perspective, but little has been said about eco-resources like *Zm.*

Source: Field-based material.(2017)

Table 4.13: The challenges and opportunities in *Zm* development as identified by the focus group discussion held in Dambakurima. The economic perspective

Economic challenges	Opportunities
I. *Zm* is undervalued in economic terms, for example, a 20-litre bucket of *Zm* costs 2 USD$ on the local market	I. Research on the potential economic impact of growing *Zm*.
II. Not a priority to developmental issues of Muzarabani for politicians.	II. Actor-network can be stretched to potential investors and consultants
III. Economic benefits unknown.	III. Attracting new inventors (new Zimbabwe's leadership economic (2018)
IV. Establishing the same mind-set and the cost involved is a challenge to the Dambakurima community.	IV. Very few value addition processes taking place right now (2018)
V. Level of knowledge about *Zm* production and management not equal among various institutions	
VI. Market not very favourable	
VII. Initial capital a stumbling block	

Source: Field-based material (2017).

Table 4.14: Challenges and opportunities in *Zm* production; the social perspective

Society challenges	Opportunities
I. *Zm* undervalued in economic terms.	I. International market comparison
II. Not a priority resource in terms of development issues from Muzarabani.	II. Value addition of the *Zm*
III. Potential economic and social values unknown	III. Opportunity for research
IV. Lack of constructive ideas among concerned institutions.	IV. Coordinating and networking of various institutions
V. Existing research oversimplifying the importance of *Zm*.	V. Dissemination of *Zm* information related to the Muzarabani case
VI. Lack of supporting regulatory framework	VI. *Zm* development will boost innovation and value addition techniques, as is being encouraged by the current government (2018)
VII. Actor fragmentation and lack of coordination	
VIII. Remoteness of Dambakurima to potential investors and buyers	

Source: Field-based datamaterial.(2017)

In addition, various questions were raised during the focus group discussions held in Dambakurima. These included:

I. What exactly can be done to ensure that the rural communities benefit from *Zm?*

II. How can the mind-sets of the diverse institutions be changed toward *Zm* production and management?

III. There seems to be great potential for *Zm* to help people adapt to climate change, but is it the same view that policy makers are prepared to explore?

IV. If diverse institutions support the idea of promoting *Zm*, are they all prepared to network and coordinate their efforts into this worthy cause?

The local people were taken as important actors in this research; hence their input was constantly referred to. Results from the study indicated that the majority of the local population of Dambakurima would like various institutions to help them to promote the production of *Zm* and derive a wider range of economic benefits, based on their inputs. A comment from one of the respondents summarised the interest.

> "I am aged eighty-oneand so happy; you discuss this topic of eco-resources and their importance to resilience discourse. Here, *Zm* is our life and people for centurieshave benefited from it. I personally think people could be better off here if they made sense out of *Zm*. We have survived harsh climatic conditions with the help of *Zm*. Without plants and wild fruits, we are nothing in semi-arid spaces likeDambakurima."
>
> (Pers.com, 2017l)

All the 70 respondents considered in the study findings were asked about their top reasons for growing and making use of *Zm* during periods of adverse weather conditions. Responses reflected the predominantly known benefits, and the top four results were economic, environmental, social (relaxation and leisure through *Kachasu* drinking) and supplementary feed during drought or flood periods. Besides these benefits, other participants indicated reasons related to health, cultural activities and promoting biodiversity. The reasons for the participants' involvement in *Zm* production were also surveyed. The known common values of wild fruits or eco-resources were identified, as suggested by (Mukhtar *et al.,* 2004).The top benefits shown by the results from *Zm* production were in nutrition and food, income, linking natural food to societal needs, resilience, and leisure. Other reasons given included the significance of *Zm* in promoting self-sufficiency, taking care of one's environment, and food variety. Since the prevailing environment was unpredictable, it was worthwhile to study how *Zm* might alleviate the suffering of the rural population, even if it was only partially.

4.4.8 Perceptions of the respondents on replanting and regeneration activities in Dambakurima

Having established how the household respondents perceived the factors that influenced the decision to take *Zm* as an optional adaptation strategy, it was necessary to understand the perceptions of the respondents on replanting and regeneration activities in Dambakurima. Only four percent (4%) of the respondents in the study area had planted a *Zm* tree. When asked what was the rate of *Zm* replanting, both men and women respondents agreed that they had no technical skills or support to grow *Zm*. Moreover lack of research and nursery plants was identified as the major cause. The major actor operating in the area tended to focus on food aid and growing of exotic trees e.g gum trees suggested one female respondent aged forty-nine (49). Those who had planted *Zm* were positive the trees planted were not common property; hence they had specific rights to *Zm* products, fruits, bark, root, wood and leaves and to exclude others in its use. The study further explored the applicability of ANT to the *Zm* commodity chain

4.5 Eco-resources and actors idea: *Ziziphus mauritiana* in Muzarabani, a semi-arid region of Zimbabwe.

4.5.1 Introduction

This part of the Chapter 4 discusses the study on *Ziziphus mauritiana*'s commodity chain in Muzarabani. This study established that a multi- purpose eco-resource, *Ziziphus mauritiana* has been part of the Muzarabani community. The chapter moves beyond the ordinary outlook of *Ziziphus mauritiana* commodity chains and resilience. Analysis suggests that geographers have

viewed this notion in a simplified way and this could be complemented by the use of Actor Network Theory. By following the *Ziziphus mauritiana,* people and other actors will enhance the understanding of their interaction. Some scholarly criticism of ANT thinking seems to be less applicable to a more advanced set of actor network thinking. In addition, the thinking can supplement a positive way of enrolling physically with the presence of eco-resources. The study emphasises the call for attention on "actor's activities" not mere "eco-resources", in pursuit of economic conduits in semi- arid regions prone to alternating hazards. This approach enables rather more diffuse actor network ideas. As a result this provides a paradigm shift from starting and ending nodes in *Ziziphus mauritiana* commodity networks. The paradigm shift will drive towards livelihoods, resilience and adaptation.

Work has been written about eco-resources and climate variability in which investigations are represented and discussed. Little emphasis has been placed on the way eco-resources are practically engaged in semi-arid spaces. This study demonstrates how materiality can be included or excluded. Questions that would help achieve this are where then is *Ziziphus mauritiana* produced? What happens to it after it has been produced? How does it help the Muzarabani community of Zimbabwe? Complex questions indeed. The first port of call, however, is to understand what commodity value chain entails in the context of Muzarabani.

Scholars have described the value chain differently (Ensign, 2001; Gereffi & Kaplinsky, 2001). However, in context, the value chain defines the overall assortment of activities from conception, different stages of production, marketing, delivery to consumers up to the final users. A range of actors and activities are found in the value chain. Production is one important aspect, but only as part of the chain. Moreover, there are ranges of activities within every link of the chain. Although usually delineated as a vertical chain, linkages are usually two-way in nature(Morzaria-Luna *et al.*, 2013). Production and marketing strategies may have influences on a product, which are also affected by downstream actors and their networks. How then do we understand the *Ziziphus mauritiana* network?

The study traced the *Ziziphus mauritiana,* in the semi-arid region of Muzarabani. Where do we start from, and where do we end? Complex questions to respond to. However, a snap short answer would take one to Muzarabani *Ziziphus mauritiana* market places (chief or headman or the councillors' homestead). Other places to market *Ziziphus mauritiana* are the grounds of the schools and clinics. Beyond Muzarabani, markets are in major towns, smaller towns, and cross borders. But is it where *Ziziphus mauritiana* originated, is produced, assembled or ends? Definitely not. Scholars debate over the origin of *Ziziphus mauritiana.*Some place the origin in Asia (Marwat *et al.,* 2008; Upadhyay e*t al.,* 2012), yet some in Africa(Nyanga *et al.,* 2007; Ouédraogo *et al.*, 2006) whilst others in both continents (Delfanian *et al.*, 2016; Kalinganire *et al.,* 2012). The fact remains that it has been a complex network (rhizomatic) involving different actors. Fields, gardens, homestead spaces and the wild are spaces where *Ziziphus mauritiana* species are found in Muzarabani.

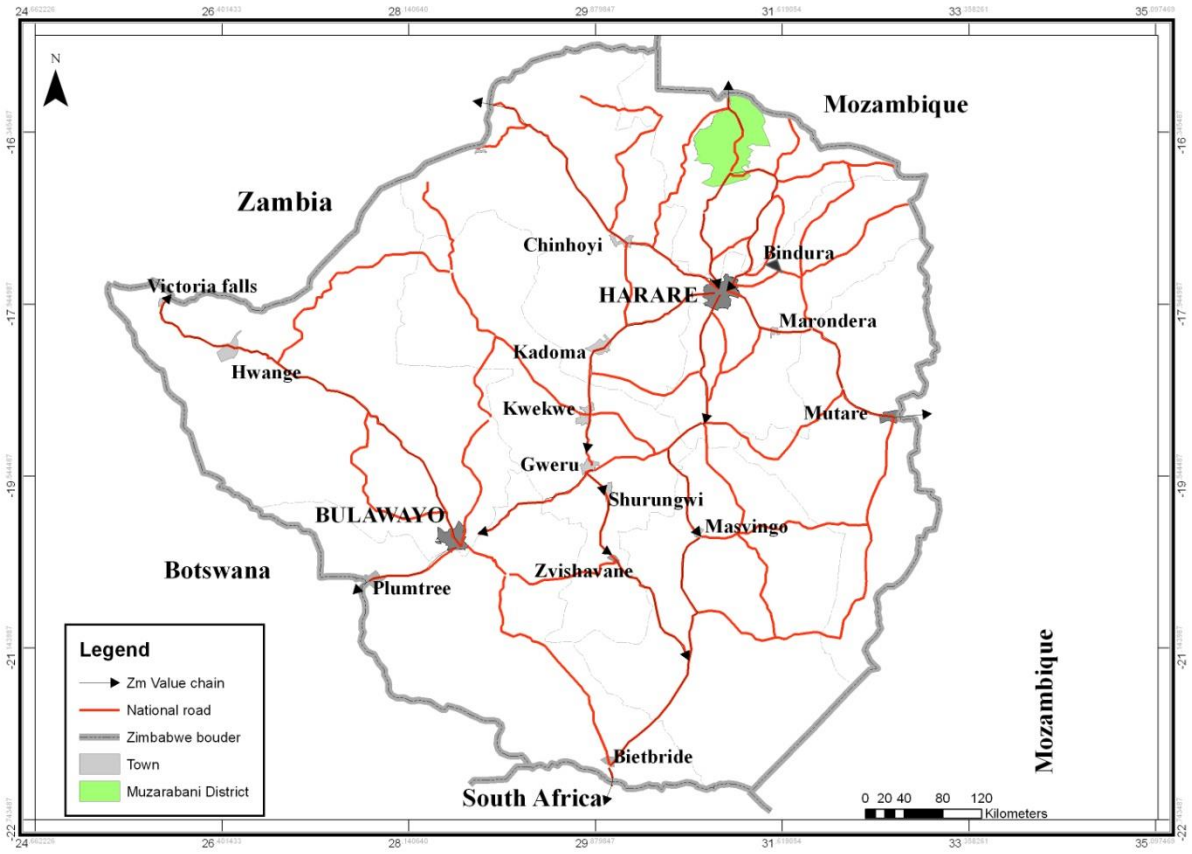


Figure 4. 6: *Ziziphus mauritiana (Zm)* commodity chain

Source: Cartography unit (2017), School of Geography and Environmental Studies, University of Witwatersrand, South Africa.

There are many markets for *Ziziphus mauritiana* in Muzarabani as shown in Figure 4.6 and at first sight they look disorganised, but a closer look reveals that they are organised. *"Ziziphus mauritiana"* are known locally as *Masau.* A range of activities are carried out at the Muzarabani *Ziziphus mauritiana* market. Goods traded range from clothes, vegetables, maize meal, farming equipment and *Ziziphus mauritiana* fruits. The study site Dambakurima is found in the northern part of Muzarabani. One would mistake the site for a remote area without life. Agreed, the area experiences drought and floods. The effects have been felt mostly by the villagers in Dambakurima. The villagers are not passive observers; for years they have resorted to their local eco-resources. *Ziziphus mauritiana* is an eco-resource with multiple functions that villagers rely on during or after hazards. There are different market places in which *Ziziphus mauritiana* is traded. However, when one is in Muzarabani *Ziziphus mauritiana* market, an appreciation of the idea that anything can have a value attached to it develops. Anything can be bartered, traded, sold, included or excluded, reassembled, assembled and disassembled. It is all about things or actors not the poor man's fruit as suggested by some scholars (Kadzere & Jackson, 1998). Anyone, anything and everything there seems an actor worth following. These interacting actors are human and non-human (Law, 2007; Müller & Schurr, 2016). The *Ziziphus mauritiana* is traded as fresh or dried fruit (Nyanga *et al.,* 2008). Others will be traded as alcoholic spirits made from *Ziziphus mauritiana (Kachasu)* which although illegal were valuable in the market. *Ziziphus mauritiana* is also a habitat area for birds, forage for animals and different products are made out of it.

The study followed the *Ziziphus mauritiana*. In Muzarabani *Ziziphus mauritiana* is brought by human labour, lorries, trucks, tractors, pick-ups, station wagons, sedans, bicycles, tricycles and people from different locations. The *Ziziphus mauritiana* is sorted into different grades by many people who are enrolled to assist in the grading process. However, trading was done before, during and after grading or sorting *Ziziphus mauritiana.* There was no stage or point marked as the starting point for trading. A few metres away from the *Ziziphus mauritiana* market, different young women and men were busy. The youngsters were involved in brewing *Kachasu,* grinding dried *masau.* What came out of their daily activities were alcoholic spirits or *kachasu,* beverages and powder used to prepare porridge (Tembo *et al,* 2008). People could be seen trading these products from *masau.* Posh cars to old Peugeots 404 could be seen in Muzarabani *Ziziphus mauritiana* market. Tonnes and tonnes of *Ziziphus mauritiana*, was coming in and out of the market. Money was changing hands, people were greeting each other, negotiating and laughing. It is true that some trade was taking place. Should it be here where it is traded or value added? Why this place? Where then if not Muzarabani *Ziziphus mauritiana* market? One striking point came out, not all eco-resources (*Ziziphus mauritina*) are regarded as "poor man's fruit"(Kadzere & Jackson, 1998).The study noted that Muzarabani is a production site. Eco-resources need to be followed as suggested by Actor Network Theory teaching. The study argues that following and giving *Ziziphus mauritiana* consideration might ameliorate our understanding of the livelihood, adaptation and resilience landscape in Muzarabani.

This study pays particular attention to *Ziziphus mauritiana* within the discourse of linearity in value chain construction. There has been wide criticism of the value chain over the understanding of the process involved in economics. Some argue, the process does not focus on lines or pathways (Gereffi & Fernandez-Stark., 2011; Hughes, 2000). An analysis of the linkage and production process of *Ziziphus mauritiana* shows thereare complex webs of economic inter-linkages. Contrary to being linear as is often suggested value chains are more space, time and socially constructed. The study noted with concern, that value chain has been and is still being described as linear (Cambero &Sowlati, 2014; Jensen & Sandrey, 2015), suggesting there are a beginning node and the ending in the *Ziziphus mauritiana* pathway. In the context of the *Ziziphus mauritiana* in Zimbabwe, there are no beginnings or endings of actors or material.

The study argues there could be no beginning and end-nodes; instead there is value chain and actor networks in different communes. The study supports and proposes academic enquiry that searches for linkages in pursuit of the starting and ending node. However, the standing fact is that the starting and ending nodes is a product of inter-linkages. Ordering as a result of actions, explains the starting and boundary discourse. No one can tell in Muzarabani where to find *Ziziphus mauritiana* market. *Ziziphus mauritiana* appear and disappear on the inter-linkage site.Çalişkan & Callon (2010)refer to it as spaces inter-weaving materials and objects. No-one can really tell the starting point and ending destination of the *Ziziphus mauritiana* value chain. However, in pursuit of the starting and the boundaries followed should be the activities surrounding *Ziziphus mauritiana.* No pre-defined analysis should be done to influence who, when and how actors will perform. Who will be powerful and less powerful should not matter, but how the actors linked is important (Latour, 2005).

Activities can be aligned or re-aligned in the same way starting and boundary edges are also re-arranged. Various scholarly works suggest the issue of boundaries and starting points when

exploring materials and performance (Callon, 2005; Hudson, 2008; Müller & Schurr, 2016). The study argues that the way the *Ziziphus mauritiana* looks and how it is organised at Muzarabani market suggests no boundaries. The way we should view the *Ziziphus mauritiana* should not be separated from how they are arranged on the study site. This observation proposes that emphasis is laid on actors' interactions.

The value addition of *Ziziphus mauritiana* involves an array of actors and moves from one site to the other. The interviews and observations carried out at the Dambakurima *Ziziphus Mauritania* market and some markets around Muzarabani, show that *Ziziphus mauritiana* travels to different sites. There are many methods used in a *Ziziphus mauritiana* market. *Ziziphus mauritiana* is drawn from different points in the semi-arid rural sites in Zimbabwe. The movements of *Ziziphus mauritiana* from the supposed places of origin in Dambakurima *Ziziphus mauritiana* market, denotes a value. Women and men at Dambakurima produce and process *Ziziphus mauritiana* into valuable fruits, spirits, medicines and animal forage. These products are sold or traded to source income and goods for the villagers. Villagers earn a living through *Masau* and sustain their families in times of need. The prices of these *Ziziphus mauritiana* products range from 1USD$ to 1200USD$ per unit depending on, the type, quantity, quality and demand in the market.

A 65-year-old male villager from Muzarabani's Dambakurima village *Ziziphus mauritiana* market had this to say;

> "We make a range of products that include; furniture wood, spirits and medicines, forages. We use what people refer to as seed waste or *Ziziphus mauritiana* waste seed, as our raw materials for *kachasu* brewing."
>
> (Pers.com, 2017m).

> "Prices of the *Ziziphus mauritiana* products range from 1 to 12USD$ per unit. We add value to *Ziziphus mauritiana*. The *Ziziphus mauritiana* adds value to our lifestyle. One can earn as much as 1200USD$ a month depending on the amount of *Ziziphus mauritiana* traded. Challenges we face due to floods or drought are somehow managed. We are able to supplement our annual income. The *Ziziphus mauritiana*products add value to different actors. They attract customers in Muzarabani and look different with our*Ziziphus mauritiana* products."
>
> (Pers.com, 2017n).

The *Ziziphus mauritiana* fruits from Muzarabani *Ziziphus mauritiana* market are also sold to neighbouring countries like South Africa, Botswana and Namibia. However, because it is informal and calls for complex clearance procedures, traders' illegal exports are generally smaller in size.

> "Our clients are many and come from different places. Generally, *Ziziphus mauritiana* for export needs to be of high quality, well dried and of smaller quantities for easy transportation abroad. Smaller quantity but high quality *Ziziphus mauritiana* items fetch higher prices. Contrary, locally large quantities fetch higher price than the small ones."
>
> (Pers.com, 2017o).

The movement of *Ziziphus mauritiana* shows that there are no boundaries or starting points. Harare market (Mbare market) seems to be a major client of Muzarabani *Ziziphus mauritiana* market. However, there are some retailers located in different suburbs and shopping centres which are part of the *Ziziphus mauritiana* value chain. Others claim to be the producers of the *Ziziphus mauritiana,* yet they don't know its origin or where it is going to end. How then can the issue of linearity of *Ziziphus mauritiana* material be explained? It is indeed in the interest of this study to start with a global perspective of the *Ziziphus mauritiana* commodity chain, that analysis is done.

4.5.2 **Could the *Ziziphus mauritiana* value chains be linear globally?**

Global economic activities are complex. Understanding the activities requires a different view. Various scholars have made an effort to contribute to the relevance of linearity to value chain studies, including (Feyssa *et al.,*2011; Gereffi & Kaplinsky, 2001; Jensen & Sandrey, 2015) who made efforts to comprehend linearity in the context of globalisation. Critiques cited the link of interlinkage and the multiplicity in the commodity chain investigation (Gregson *et al.,* 2009). Preference was made to the global end users at the expense of the producers and local consumers. Calls were made in the recognition of the web of interaction that included knowledge transfer in the value chain.

The *Ziziphus mauritiana* commodity chain is mainly locally concentrated. The study argues that the *Ziziphus mauritiana* commodity chain's linearity should go beyond its directional characteristics. Instead it should provide room for the identification of different actors and analyse their roles when they relate. The inclusion of relational consideration will oust the challenges associated with the idea of linearity in the commodity value chain. The study suggests the analysis should go beyond the production, trade and consumption idea. Villagers in Muzarabani and the entire nation can benefit more from *Ziziphus mauritiana*. Each actor, whether human or non-human needs to be linked and understood. This can only be justified by refuting the starting and the ending notion. Tracing actors within the commodity chain should be analysed using the ANT approach. It has been advanced that ANT can ameliorate the understanding of different issues that are included in the commodity chain. The meaning of the *Ziziphus mauritiana* through ANT is easily conveyed. Knowledge transfer is considered a vital actor in the commodity chain. All the directions, destination and commoditisation of *Ziziphus*

mauritiana if well explained help us deduce meaning. *Ziziphus mauritiana (akasongole* (Bemba): *musawe* (Tonga): *massau* (Nyanja) are used in Zambia to produce export quality spirits; in India and China to make furniture and pharmaceutical products. Large plantations of *Ziziphus mauritiana* are found in Egypt and some Asian semi-arid regions (Azam-Ali *et al.,* 2006). According to Kalinganire *et al.*, (2008) in Malawi and Zimbabwe, there are companies that exist though not many that specialise in trading of wild fruits and *Ziziphus mauritiana* being among the highly preffered (Kadzere, 1998) and best selling. They study established that meaning could be deduced from *Ziziphus mauritiana* knowledge transfer through networking.

The analysis is directed towards ignoring the starting and ending mentality tracks actors, consumed commodities, knowledge movement and gives the meaning of *Ziziphus mauritiana.* In a global perspective recent approaches that have tried to explain the commodity value chain include; Global Commodity Chain (GCC) and Global Production Network (GPN) (Cambero & Sowlati, 2014). Economic activities are comprehended as a series of value addition. They are viewed as complex inter-connected actors. The GPN and GCC support the idea of understanding complex webs of interaction. The GCC approach denounces linearity of the value chain as its greatest handicap, and supports the idea of understanding the complex network (Morris & Fessehaie, 2014). The Actor Network Theory approach introduces both human and non-human actors in the value chain frameworks. Dis-configuration and configuration of actors linked to commodity value chain is done through the lens of ANT. All actors are included in the networks. Interviews carried out with *Ziziphus mauritiana* vendors, traders, and consumers showed that networks help to understand the commodity value chain of *Ziziphus mauritiana.*

> "The networks involve actors from Muzarabani, Bulawayo, smaller towns and those from farms. All actors are important. You can only understand the value of *Ziziphus mauritiana* if you interact with all. Each has his or her own story."
>
> (Pers.com, 2017p).

Actors that are dependable, stable and uncompromising are worth tracing according to the analysis of commodity chain (Rice, 2014). The trace of the *Ziziphus mauritiana* also needs to consider willing actors. Not all actors are enrolled; those who are interested need consideration. At Muzarabani *Ziziphus mauritiana* market, where *Ziziphus mauritiana* was sold and barter traded, The unofficial traders known locally as *Makorokozas* and traders easily join the network. The actors had different agendas though.

Close analyses of *Ziziphus mauritiana* production show that new management, uses and products are given. Examples of products include; medicines, food, beverages, and many other items used for different purposes. Eco-resources are known for the intensification of off-farm proceeds to complement farm undertakings and provide finance for supplementary input use. *Ziziphus mauritiana,* believed to be an ordinary fruit tree, assumed a changed status at Muzarabani *Ziziphus mauritiana* market. In wider spheres it is regarded as raw material or finished product with value. These products have different values based on what they have become (Mithöfer *et al.,* 2006;

Tembo *et al.*, 2008). These products can also at one point be considered as mere fruits and could also turn into useful raw materials. A complex scenario, with no beginning and ending node. It is not easy to deviate from the starting end line of thinking. Economic actions are complex. Over the years new ways of understanding the economic complexities have been developed. Efforts to get rid of the idea of (linearity) in issues to do with value chains and *Ziziphus mauritiana,* have not been easy (Jensen & Sandrey, 2015). A closer analysis of the *Ziziphus mauritiana* shows that there is nothing linear about them. The *Ziziphus mauritiana* production and movement is all embodied in social things and economic sense (Ensign, 2001; Mithöfer *et al.*, 2006). The complexities of the *Ziziphus mauritiana* value chain explain some of the scholars' arguments, which suggest the importance of interaction and links. It is easier said than done in the *Ziziphus mauritiana* value chain analysis. For one to get rid of *Ziziphus mauritiana* completely seems a mammoth task. *Ziziphus mauritiana* can, at any point, appear, disappear and reappear. Nothing concrete can be attached to it.

One is then tempted to question the logic behind considering *Ziziphus mauritiana* as an eco-resource based livelihood, adaptation and resilience approach in semi-arid regions. If the radical approach ANT allows us to accept the almost impracticable (Elder-Vass, 2015). No starting or ending. Can we be guided by unsystematic and chaotic things? True nothing provides a solution except the radical methodology of ANT. All actors, irrespective of the human or non-human component, should be accorded a chance to be explored in terms of their roles in the network. ANT seems certainly a very promising way considering the research argues that networks, understanding are the way forward. The periphery and boundaries matter more than the starting and ending story.

4.5.3 **Toward the eco periphery idea**

Ziziphus mauritiana at Muzarabani was tracked. Different forms of products were produced and reproduced. Others in their fresh or dry *Ziziphus mauritiana* form were sold as fruits. *Kachasu,* dried and powdered *Ziziphus mauritiana* were being sold

Where do you sell these products? A 40-year old woman who had been a vendor for the past 18 years had this to say;

> "Anywhere in the world a *Ziziphus mauritiana* product from this place can be sold. It can be here or there. People come with different minds. But what l know is *Ziziphus mauritiana* products are bought every day during the harvest peak period. What l don't know is by whom, or when, where it is going to be bought?"
>
> (Pers.com, 2017d).

Evidence from research, interviews and observation supported Tatenda's view. People were coming from Muzarabani, other cities, rural areas, and farming communities. Surely one could not tell their origin; hence *Ziziphus mauritiana* could end up anywhere. Some of the *Ziziphus mauritiana* could find a way back to Muzarabani just after an hour or so. Some of the *Ziziphus mauritiana* products crossed borders since cross-borders could also be seen shopping around. Others made a fortune, others cried foul; a mixed base really at Muzarabani *Ziziphus mauritiana*

market.

Villagers who used and sold*Ziziphus mauritiana* around Muzarabani were visited. Those who were external actors included small and large scale informal traders from different geographical spaces. During the *Ziziphus mauritiana* harvest peak period lorries, buses and pick-ups could be seen going up and down. *Ziziphus mauritiana* was the main reason for the flow of transport. There was life in these *Ziziphus mauritiana* markets, despite the harsh climatic conditions faced by Muzarabani at the time of conducting the research (2015-2016). Cars, commuters and heavy trucks coming in and out. Some people spent their time brewing, drinking, eating and exchanging information. Some were having snap shots (photos).

Children asking endless questions at these *Ziziphus mauritiana* markets.

i. What is this? Is it *Ziziphus mauritiana?*

ii. Where is it coming from?

iii. Who needs it?

iv. Why *Ziziphus mauritiana*?

v. Where will it go?

Complex spaces being created by *Ziziphus mauritiana.* Zimbabwe has been experiencing an economic meltdown and hazards since 2004. Despite the challenges faced, business has been going on in Muzarabani *Ziziphus mauritiana* market. Whilst big industrialists are not performing well in bussiness *Ziziphus mauritiana* industry has been steady and growing said one vendor. However, another male respondent had a different view:

> "You have to be strong to strive in the *Ziziphus mauritiana* business. Our economy has not been good and the*Ziziphus mauritiana* industry has not been an exception. One needs to know how much worth his or her *Ziziphus mauritiana* is, and ask at least a fair price for it." (Pers.com, 2017r).

(Pers.com, 2017r).

Discarded *Ziziphus mauritiana* is needed at Muzarabani *Ziziphus mauritiana* market. The unemployed youth and some adults have been part of the actors or suppliers of *Ziziphus mauritiana.* The actors are different and come with different views about *Ziziphus mauritiana.* Other *Ziziphus mauritiana* traders employed the youth as *Ziziphus mauritiana* collectors. Other youths were employed as *Ziziphus mauritiana* graders. Women and some girls were also found at this site, aiding or involved as traders, and otherswere selling food items. Different activities take place at the Muzarabani *Ziziphus mauritiana* market, all because of *Ziziphus mauritiana.* Where exactly did the *Ziziphus mauritiana* traders make profits? Who paid who? Who was powerful? Who was not? The complex movement of *Ziziphus mauritiana,* as an actor, makes it difficult to pin-point exactly where profit was made. The truth of the matter however is some won and others lost. The study argues that anyone in retailing strives to make a profit. Interesting evidence from the Muzarabani *Ziziphus mauritiana* market site supports the preceding statement.

Big Lorries with well labelled stickers, others without, were found transporting *Ziziphus mauritiana* fresh or dried. Interviews revealed that some processed *Ziziphus mauritiana* found their way to low and high density suburbs and some to light industrial sites; other found their way out of the country. Goods will be made of the *Ziziphus mauritiana* (Nyanga *et al.,* 2008)somewhere. Could one safely say that this is the end or the beginning of the *Ziziphus mauritiana* commodity chain?

The study argues that the *Ziziphus mauritiana* commodity value chain has no starting or ending node, only ordering. Someone's *Ziziphus mauritiana* is another actors' raw material. Where one sees no value, others see a value. It depends on who is involved and where. Are they interested in *Ziziphus maurtiana*? How *Ziziphus mauritiana* mobilised and what is the end product? Scholars of note have argued that these world class commodities are not all from the assumed raw materials (Cambero & Sowlati, 2014). *Ziziphus mauritiana* after being destroyed and processed match the international commodity grade (Ensign, 2001; Morris & Fessehaie, 2014; Rice, 2014). Comprehending the movement of *Ziziphus mauritiana* at Muzarabani. *Ziziphus mauritiana* market, one can use the commodity value chain or the global value chain and analyse the importance of *Ziziphus mauritiana*. However, this study argues that the mentioned approaches are not sufficient to explain the way in which *Ziziphus mauritiana* moves. The reasons being their bias to the end and beginning philosophy. Additionally, *Ziziphus mauritiana* is not formally exported from Zimbabwe.

4.5.4 **Periphery ideas creation.**

Following the *Ziziphus mauritiana,* gradually convince this study researcher that there is no starting and ending node. Bringing in the idea of the periphery proposes a new way of analysing the starting and ending discourse of *Ziziphus mauritiana* in scholarly work (Gille, 2007). Scholars have openly attested that *Ziziphus mauritiana* is regarded as poor man's fruit which can be found in a specific location, namely sem-arid regions.

A close look at the *Ziziphus mauritiana* products at Dambakurima gives a different version. Following the *Ziziphus mauritiana*, means reporting the value of different sites and spaces. The evidence puts to rest the idea of pre-supposing. People need to think and experience the networks of an actor. Each time one thinks of things there is a need to follow according to the thinking (Latour, 2004; Rice, 2014). Indeed, *Ziziphus mauritiana* fruits and products are eaten by poor people, but to understand value one needs to analyse the so called poor man's fruit. Scholars have proved people wrong (Morris and Fessehaie, 2014); *Ziziphus mauritiana* has a value. Following the *Ziziphus mauritiana* could also give positive results to those who underestimate its importance in Muzarabani during and after natural hazards episodes. It is not easy to deviate from the starting and ending line of thinking. Economic actions are complex. Over the years new ways of understanding the economic complexities have been developed. Efforts to get rid of the idea of linearity in issues to do with value chains and *Ziziphus mauritiana*, has not been easy (Cambero & Sowlati, 2014; Jensen & Sandrey, 2015). A closer analysis of the *Ziziphus mauritiana* shows that there is nothing linear about them. The *Ziziphus mauritiana* production and movement is all embodied in social things and economic sense (Mithöfer *et al.,* 2006). The complexities of the *Ziziphus mauritiana* value chain explain some of the scholar's argument, which suggest the importance of interaction and links. It is easier said than done in the analysis

of the *Ziziphus mauritiana* value chain. For one to get rid of *Ziziphus mauritiana* completely seems a mammoth task. *Ziziphus mauritiana* can at any point appear, disappear and reappear. Nothing concrete can be attached to it.

One is then tempted to question the logic behind considering *Ziziphus mauritiana* as an eco-resource based livelihood, adaptation and resilience approach in semi-arid regions. If the radical approach ANT allows us to accept the almost impracticable, *Ziziphus mauritiana* is an actor worth following just like humans (Elder-Vass, 2015). No starting or ending. Can we be guided by unsystematic and chaotic things? In truth nothing provides a solution except the radical methodology of ANT. All actors, irrespective of a human or non-human component, should be accorded the chance to be explored in terms of their roles in the network.

4.5.5 **Creation of the *Ziziphus mauritiana* Periphery**

The study revealed that the *Ziziphus mauritiana* has value and has no starting or ending nodes since it is a wild fruit tree. *Ziziphus mauritiana* can, in ANT terms, interest different actors as it is being followed. Different actors are enacted and assume different roles. The focal actors are the influential (*Makorokoza)* middlemen traders in Muzarabani *Ziziphus mauritiana* market. The *Makorokoza* convince the other actors that it is acceptable to assume different roles. Evidence from studies shows that *Ziziphus mauritiana* renders a practical way for actor's alignment during periods of environmental stressors though success is not always guaranteed. Hence, there is a need for enrollments where it aligns with the network, ensuring success (Garrity *et al*., 2007). The idea of enrolment led the study to seek insights from the respondents about the importance of *Zm* and how the community could benefit better from it. The Figure 4.7 shows an example of a mind map/drawing that illustrates how *Zm* can aid and improve the livelihood of the poor in a semi-arid space.

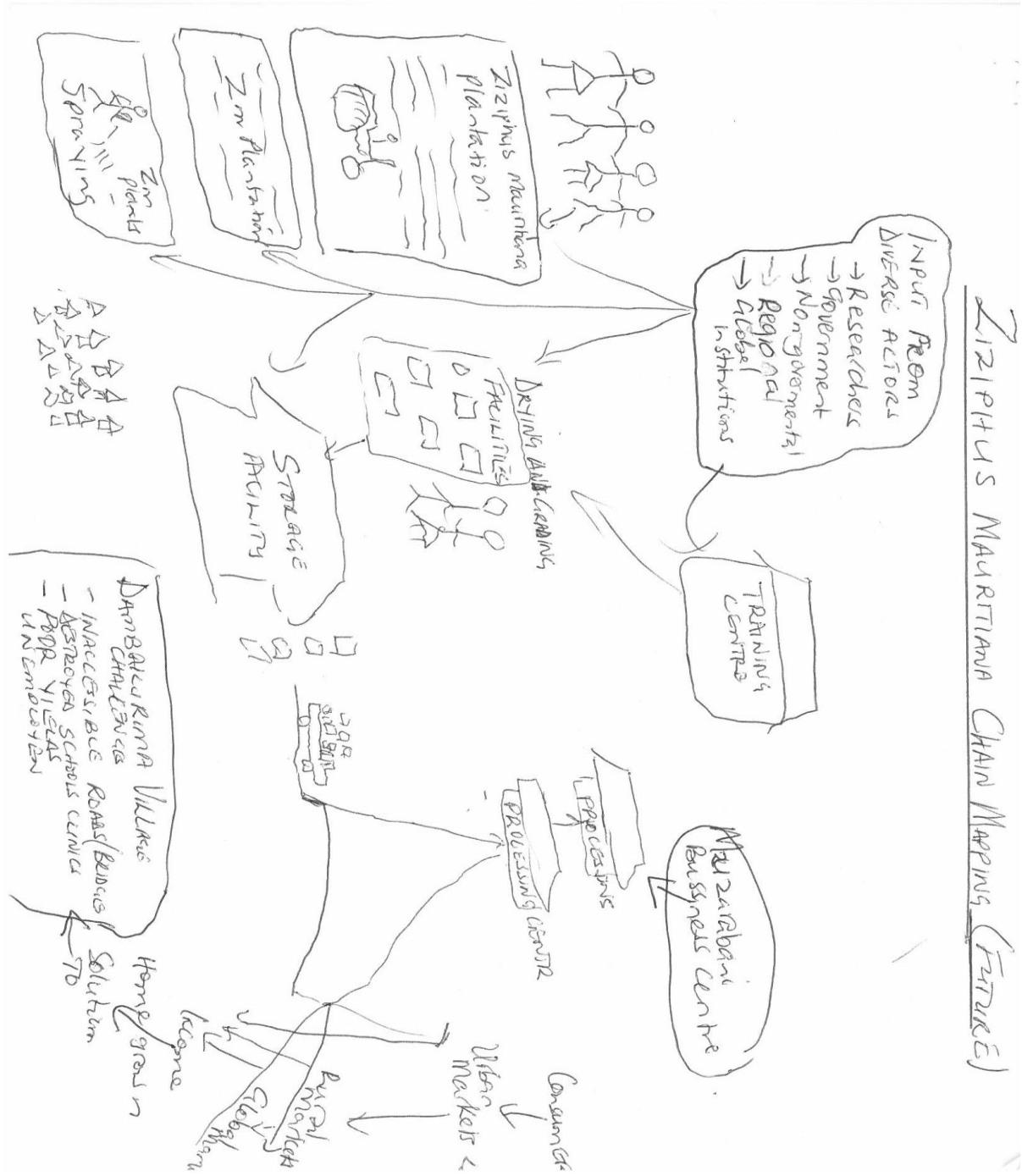


Figure 4. 7: Dambakurima villager draws what he thinks *Ziziphus mauritiana chain* in Dambakurima should look like

Source Field material 2017

If people are to consider *Zm* as a solution to some its environmental problems shown in Plate 4.4 and 4.5 (Main linking road destroyed 12 years ago) could get immediate and sustainable solutions. Producing *Zm* at commercial level could result in the community attending their environmental problems using their own resources.



Plate 4.4: Part of Hoya bridge in Muzarabani District Zimbabwe after damage by floods in 2001 to date not yet attended to (2017)

Source: Field-based data, 2017



Plate 4.5: Part of Dambakurima – Harare Highway which *Zm* producers and traders use in Muzarabani

Source: Field-based data, (2017)

Mobilisation strives to answer how capable the enrolled actors are. The representation of actors is explained. Networks stabilise and take shape (Ruming, 2009). Answering the questions on interessment, enrollment and mobilisation of the actors on the study site, resembles the notion of the periphery of *Ziziphus mauritiana.* The periphery notion exists in the interlinkages of humans, spaces, and non-human actors (Orefice & Rocha, 2014; Ensign, 2001). It is important to understand how these actors have added value at each stage, irrespective of their geographical position in the *Ziziphus mauritiana* commodity value chain. It is important to know how the *Ziziphus mauritiana* is arranged. Who is enacted and who is not? Consequently, this is far from giving directions of where *Ziziphus mauritiana* starts or ends. Following the actor is the panacea to understanding the value addition attached to *Ziziphus mauritiana.*

This part of the chapter used Actor Network Theory to argue against the known approaches of the commodity value chain and Global Commodity Analysis. The study argues that the understanding of the *Ziziphus mauritiana* commodity chain is complex. Hence a different lens is required to explore the complexities. Further extension of the argument is the need for a deeper understanding of the assumed starting and ending notion of commodity chain analyses. Methods previously used overlooked how the complex process of the value chain is to eco-resource. *Ziziphus mauritiana* take any form and value, depending on space and time. The periphery idea overrides the identified challenges, particularly were different actors put into perspective. Results from the study demonstrated that *Ziziphus mauritiana,* like any item, can be ordered or disordered, through following actors. *Ziziphus mauritiana* needs to be followed to make sense out of it. However following the actor is no easy task; it is complex and needs a radical eye in the form of ANT. The study does not denounce other approaches like, value commodity chain and global chain analysis, but instead continues from where they left off. The critique is made mainly because there is no beginning or ending in methodological approaches. Activities need to be followed to deduce meaning out of them. There is no need to make a pre-supposition (Pollack *et al*., 2013;Whatmore, 2006).

4.6 Summary

The use and management of *Zm* in Muzarabani as a resilient and livelihood option is complex and is made up of diverse actors that must interact and respects the role of each other comply with the requirements of sustainable supplier management. Figure 4.4 illustrates diagrammatically the mapping of vital actors/institutions for facilitating *Zm* as an optional adaptation strategy to extreme weather conditions. This diagram (Figure 4.4) presents visions of the limitlessness of the *Zm* commodity chained network of an area prone to climate variability. The study established that *Zm* offers an important yet unrecognized role in Muzarabani during and after adverse weather times. In view of the complexity associated with *Zm* networks, the study argues that all actors (human and non-human) have the potential to encourage the use of local eco-resource in resilience and livelihood discourse of semi-arid spaces and this is seen as a vital element of sustainable development.

The study established that *Zm* plays an important role in providing household income, food, beverages, medicines and fodder for the study area. Through the use of local eco-resources like *Zm*, the rural poor are given the chance to contribute meaningfully to their own resilience through the day to day experiences. The eco-based approach based on the use of ANT lens

ensures that *Zm* valued creation is anchored at individual communities involvement through the use of local eco-resources. Figure 4.7 shows a sketch map of the potential for *Zm* in an area that is remote and prone to floods or drought drawn by a visionary villager. There is a possibility with massive production of *Zm* investors could relocate to Muzarabani *Zm* production spaces thus allowing the creation of industrial activities and jobs. Focus on local eco-resource benefits both the poor people and other actors in that the local people acquire a chance to contribute to the economy whilst other actors like investors benefit economically from reduced costs and prices. The excerpt from an EMA official winds it up:

> "Focusing on *Zm*, therefore, represents a unique resilient approach, with unforeseen economic, political, ecological and social benefits for the locals and various actors that include the government and the entire Southern Africa region." (pers.com: 2017p)

The results shown in this chapter demonstrated the various uses of *Zm* in Muzarabani in which the locals have made use of to align with climate variability demand in the search for livelihood and resilience. The increased demand for *Zm* due to the increased population of the study area has led to the destruction of the important wild fruit tree to some extent see Plate 4.2 and 4.3. The Chapter 4 discussed the role of the various institutions in the management of *Zm*. The study argues sustainable utilisation of the *Zm* calls for a paradigm shift that places the importance of the different roles of various actors and improved eco-friendly awareness at the centre. Laws and regulations on a global and national scale have to some extent influenced the entire natural resource management system in semi-arid spaces and the overall adoption of an eco-based resilient option practices.

CHAPTER 5

ANALYSIS AND DISCUSSION

5.0 Introduction

This Chapter offers an analysis and discussion of the importance and the meanings of the findings presented in Chapter 4. The results have to some degree revealed how an unrecognised, but important eco-resource *Ziziphus mauritiana* engages with diverse actors in an area prone to the effects of climate variability (floods and drought). The Chapter addresses the research's main thrust and objectives outlined in Chapter One also as is informed by literature. The aims and objectives as stated were geared towards investigating the contribution of *Zm* to livelihoods and its role in natural hazard mitigation strategies and resilience through an analysis of the networks associated with it. This also covers the entire *Zm* commodity chain as *Zm*producers interact with different actors on different societal levels from producing, managing up to the *Zm* final user. As different actors benefit differently from *Zm*, the study also took note of the way the environment is placed by the activities of the diverse actors in their bid to benefit from *Zm*. Apart from the above-stated aim the study also sought to investigate how ANT could be used to improve the understanding of eco-based resilience in Muzarabani District, Zimbabwe.

5.1 *Ziziphus mauritiana* uses and resilience discourse

The results are supported by literature from Thondhlana *et al.,* (2012) ; Simatele & Simatele, (2014) who view natural resources, skills and people as the main actors that facilitate adaptation to environmental challenges, and fruitfully negotiate the daily experiences of people. Discussions involving diverse actors highlighted the importance of *Zm* to food security in times of stressful or adverse weather seasons. The diverse products from *Zm,* such as porridge and crushed dried *Zm* used to prepare no alcoholc beverage known in Dambakurima as *gununzvi*, are used as a dietary supplement, and coping strategy in periods of food shortage to supplement diets and ensure a locally available safety net for the Dambakurima community; at the same time supporting their livelihoods and resilience. When crops fail, the utilisation of *Zm* products, by both women and men, act as an avenue for managing the trade or commodity chain and consumption throughout the seasons. In Kenya, research work by Quandt *et al.,* (2017) complements the idea that *Zm* as an eco-resource can offer an optional source of income and food that can build resilience and livelihood paths. Having *Zm* as a supporting livelihood strategy that can also be used during extreme weather events, means it can help build livelihood resilience by better equipping households to handle the effects of climate variability and adapt to changing environmental conditions. *Zm* has been shown, in this study, to provide a range of benefits to the Dambakurima community. For example, it can enhance fodder stocks for domestic animals, protect fences in many instances and improve rural household resilience and livelihoods through offering additional products like alcoholic beverage made from Zm fruits known as *Kachasu* and fruits for domestic sale or consumption. *Zm* constitutes a vital income source for the population at Dambakurima. This is also supported by Thondhlana *et al.,* (2012)who reported in his study of South Africa's Kgalagadi Transfrontier, that the harvest and sale of wild edible fruits often provides one of the only means of access to the cash economy. Badimo *et al.,* (2015) in support

of this observation highlighted that in Gweta, a rural space in Central Botswana, wild fruits contribute significantly to the income of the villagers.

Respondents from Dambakurima, reported that *Zm* is sold by women, men and children, mainly in informal markets that include; the home, shopping centres, roadsides and city markets. The sales of *Zm* offer income used to sustain some family needs, such as paying for basic food requirements, medical costs and school fees. *Zm* is also used to prepare perennial alcoholic and non-alcoholic beverages that are of cultural and economic significance to the Dambakurima community. Based on the field responses, *Zm* contributes to improving rural food security and resilience by providing readily accessible, affordable, nutritious tasty fruits and snacks that are used throughout the year. Even though the study established that the Dambakuriama community relies significantly on *Zm,* it cannot offer everything that is required for the community to have a complet diet. This is supported by Berihun & Molla (2017), whose study in Ethiopia suggested that wild fruits can help maintain household food security and nutrition during the drought season, but it cannot be a full panacea to climate variability challenges.

Zm, though it is the dominant fruit species, it is not evenly distributed amongst the Dambakurima community, however, in specified geographic locations, it has an important role to play. Here, results are related to those described by Mahapatra *et al.*, (2012)who conducted a study in India showing that members of the district derive different returns from the selling of indigenous fruits. These findings indicate, there are reasons for the differences in return, and the respondents gave ethnicity and livelihood priority as important factors that determine access to *Zm* in Dambakurima. In agreement with the observation of Milgroom *et al.,(*2014) cultural factors can be a barrier in terms of *Zm* use. However, very few scholarly works mention cultural factors as a reason for the uneven distribution of natural resources (Madamombe, 2004). In context, the results of this study revealed that determining access to *Ziziphus mauritiana* pivots on the complexity of the social linkages experienced in the study site. An analysis of different actors revealed that the use and distribution of *Zm* were located beyond the scope of known adaptive and resilience discourse, as supported by (De Schutter, 2011). The responses from key informants pointed to the fact that it is not all about access to *Zm*, but the differences and interactions involved. Access to *Zm* is possible if people agree to terms and have that as a livelihood priority. In a broader sense pronounced inequalities and struggles to access *Zm*are culturally oriented.

It is, however, important to note that the collection and sale of *Zm* and its related products can provide significant support to local livelihoods and resilience, particularly for those who lack the capital capacity to engage in other optional livelihood activities. *Zm* offers an indirect contribution towards improved livelihoods and resilience allowing access to other alternative food sources through the income derived by their sale. This trade of *Zm* promotes networking. Dambakurima has been linked with different urban centres and has contributed significantly to the livelihood of people in urban areas, where intermediaries supply *Zm* in different markets. However, using ANT, an analysis of the *Zm* local supply chains and their actors, including rural-urban linkages, revealed the need to settle at a correct valuation of the *Zm* and its related by-products, and to assess its role and potential at local, national and international levels. Many actors use the *Zm* trees, and their interactions are complex. Traditional patterns show, to some extent, how *Zm* is used. However, evidence of the research showed the change of gender roles

mainly because of economic benefits assigned to the use of *Zm*. The results suggested that indigenous knowledge systems are important in managing complex environmental, economic and social linkages. The results contrast with the traditional poverty-environment discourse based on the fact that people are the main threat to the environment. As suggested by one official who has twenty years' experience with the FCZ, local inhabitants use and manage their eco-resources sustainably.

The majority of the interviewees specified that the different actors involved in the use and management of *Zm*, have different views towards the use of *Zm* as an approach to livelihoods. These actors' facilitation to the *Zm* agenda is not the same. Those that support the use and promotion of *Zm*, however, have their own challenges that include: lack of political support, lack of networks among actors and lack of research and technical support. In addition, evidence showed that there are gaps and unexploited avenues for enhanced *Zm* management aided by natural regeneration for the benefit of the rural poor in semi-arid spaces. Evidence of the study sites showed that a lack of basic infrastructures such as bridges and *Zm* market access provides unfavourable subsistence support to local resilience and livelihoods.

The importance and recognition of different actors is endorsed in this chapter; hence the use of ANT was shown to be a useful tool for understanding climate change and adaptation issues. Together with diverse complex institutional structures and facilitating factors, the networks and collaboration activities are tipped to be the enabling panacea to eco-based resilience or adaptation approaches. The interlinkages of formal and non-formal structures, both human and non-human actors govern the collection, processing, trading and management of *Zm* in diverse ways. The study revealed that for *Zm* to contribute significantly towards food security, livelihoods and act as a coping approach for increased resilience, responsible authorities or policy interventions need to embrace diverse actors when implementing restrictive measures that will affect local resilience and livelihoods. The minor ethnic group found in Dambakurima *Vavhitori*, , raised concerns over unequal distribution and access to *Zm*. Hence, it was observed that equitable access, particularly for the less privileged actors within communities, is imperative if natural-based livelihood and resilience interventions like *Zm* harvest are to benefit all local actors across all ethnic groups. This will also ensure the *Zm* are conserved by all as supported by Badimo *et al.,* (2015)who suggest that users of wild fruits tend to conserve the eco-resources they derive benefit from which further supports the sustainability of the *Zm*.

Results showed that benefits from *Ziziphus mauritiana* are not evenly distributed among diverse actors. Various human or non-human (actor) based factors influence the variation. The actors include ethnicity, eco-resource needs, livelihood priorities, power exclusion, inclusion and social standing. The respondents established that the Muzarabani community perceived that there was an inequitable distribution of *Zm* to its different members. However, benefits derived from *Zm*are not always unequally distributed. Respondents revealed that some owners of *Zm* are involved in the care economy. For example, sharing with members of the community that can help them in the collection of *Zm*. Also when picking *Zm*, the majority of the respondents views it as "respectful" practice not to pick every raw *Zm* in the area. Thus, many of the elders in Dambakurima village believe in only harvesting enough *Zm* for themselves and their household members. The remaining *Zm* should be distributed to those members of the community such as elders who are unable to harvest anymore. However, given the fact that benefits are a result of

the complex interaction between different actors, in some instances, for one to benefit there are costs involved. Powerful actors, whether within or outside Muzarabani, tended to benefit more from *Zm*. There is more to it than is immediately apparent. Here, the researcher found results consistent with those reported by Quisumbing *et al.,* (2014)who show that the type of assets people have control over influence the node at which they participate in the fruit value chain. In addition, the successful rural development and management of resources is used to determine the way in which people are able to accumulate assets that can help them buffer the effects of climate variability. Evidence from the study showed that households with more *Zm* trees in Dambakurima were better placed to handle their daily needs during periods of flood or drought. These findings are consistent with those of McCord *et al.,* (2015) who found that the importance of wild fruit trees was dependent upon the total number of trees a household had on their farm. This perhaps explains why almost everyone interviewed emphasised the importance of *Zm*, as supported by the list in Table 4.1.

The respondents revealed that using *Ziziphus mauritiana* has social status implications, further complicating the understanding of issues surrounding *Zm*beneficiation in Dambakurima. Deeper analysis showed that the *Zm* dependent indigenous Dambakurima community is a group of actors from different cultures namely the; original inhabitants (*Vakorekore*), environmental migrants (mostly *Vavhitori*), government officials, tradesmen and labourers; all with diverse interests as well as livelihood preferences. The various actors have different taste in terms of relationships, preferred social institutions, histories and socio-ecological backgrounds. The mentioned attributes shape livelihoods based on *Zm*. These findings are consistent with those of Quandt *et al*., (2017) in Isiolo County, Kenya which found, for example, that fruit trees do not only offer (financial capital) an income, they can also have other positive health benefits and provide money for education and human development (human capital).

Origin of certain actors is important to *Zm* distribution. As evidenced by the study, original inhabitants had more *Zm* tree species. The environmental migrants arrived in the district later, hence theiraccess to and benefits from *Zm* cannot be compared with the original inhabitants. This late arrival forms the basis of their exclusion in most cases of *Zm* use and distribution. *Zm* has been used for generations in Dambakurima and has cultural significance and cultural identity to its community members. The community has, over the years; also used their cultural identity to sustainably manage the *Zm* and in the process contributes to the known benefits of the resource. The culture developed has also played a central part in local food and beverage production, domestic animal health, and management of eco-resources process. A similar study in South Africa by Shackleton & Gumbo (2010), reported that wild fruits traded in different local markets hold a key place in local culture as they are the most preferred and have, in most circumstances, no commercial substitutes.

The complex web of linkages by actors showed that the Dambakurima case needs multiple theoretical explanations. Understanding the diverse actors that interact with *Ziziphus mauritiana* called for a multi-sectoral approach, making use of different theoretical approaches that factor in the role of diverse actors. *Zm* is considered an actor in between context of this study, framed by other actors', livelihood priorities and individual social capital, for example, owning livestock which feed on it. This view is supported in a study by Lakerveld *et al., (*2015) when they ascertain that the flows of eco-resources services are made by complex, dynamic site and temporal-specific

systems that operate under unpredictable conditions. This complexity often makes it difficult to resolve an appropriate course of collective action to pursue sustainable livelihoods. In times of crop failure, due to drought or floods, the maintenance of *Zm* chain or flow to the Dambakurima community was reported to be part of the only lifeline presented. According to Tanner *et al.,* (2015), a resilient livelihood sustains well-being despite ecological, economic, cultural, social, governance and political shocks. Results show that it is no exaggeration that *Zm* can help build livelihoods, food security and resilience to adverse weather conditions. In addition the respondents, through interviews, revealed that *Zm* was not the only source of livelihood neither is it the main livelihood activity for any household in Dambakurima. It would also, however, be plausible to argue that in times of extreme weather events it can and recurrently does become a key source of income, food, cultural and ecosystem services. If appropriately harvested, *Zm* could be one of the diverse sources of cash income for the Dambakurima people with low cash income because they are treasured by local people and are often traded in different markets. Furthermore, with the increased demand for nutritious, healthy and natural supplementary food in modern rural and urban society, wild fruits have attracted worldwide interest. In order to properly utilise the wild fruits resources, the following are some suggestions that could help: 1) properly exploit and improve conservation and management of wild food plants; 2) focus on scientific research on wild food resources; 3) protect the natural environment and habitat for wild food plants.

However, destructive *Zm* harvesting is a major concern and in the existing study, this was observed to occur in different parts of the tree including the root, leaf and the entire plant. This destructive way of harvesting will cause serious consequences from both the food security, resilience and the sustainability of *Zm* point of view. The management and sustainable utilisation of *Zm* and other fruit species with multiple uses deserve consideration. The potential losses are not only limited to *Zm* species, the indigenous knowledge associated with the sustainable utilisation is also threatened. Therefore, systematic recording of indigenous knowledge and eco-resources is of great importance in Muzarabani. Along with economic development and increasing income, only a few people want to collect wild edible plants. The younger generation is becoming less interested in them, thus causing the loss of traditional knowledge. In Dambakurima some respondents confirmed their commitment to serve as environmental watchdogs to pursue more money from wild fruits like *Zm*. With the convenience of transportation, residents can buy more vegetables from the markets than ever before and do not need to collect wild species. However, Dambakurima is a more remote rural community where bridges and roads have been affected by floods. Transportation is still problematic and people rarely go to the urban market, and indigenous knowledge about *Zm* is relatively intact. It is essential to note that even though the traditional indigenous "sustainable" ways of harvesting *Zm* still exist in Dambakurima, respondents raised concerns over destructive harvesting practices. This was also echoed by Thondhlana & Shackleton (2015)in their study in South Africa where they observed and warned that some of the harvesting practices used by the locals are not always sustainable, indicating that at times some local people have destructive tendencies over their natural resources. Given this background, the researcher reasons that the existing *Zm* practices used by the Dambakurima community, if not managed properly, may possibly lead to *Zm* depletion in the long run. This information should be factored in, within existing and future local

resilience, livelihoods, eco-resources management and conservation discourse to ensure sustained benefits to the semi-arid rural people.

In support of the same view, Badimo *e tal., (*2015) revealed in their study that harvesting wild fruits in Gweta Village is done sustainably by locals with minimal effect on native wild fruits species by locals. However, the respondents in Dambakurima are concerned over the insensitive and over-exploitation of *Zm* by "external actors and other members of the community who do not own their own *Zm* trees" as they are careless and, usually, over harvest the *Zm*, leading to its slow regeneration capacity. In most cases, these are environmental migrants that would have settled later and do not own *Zm* of any significant amount. Excluding the environmental migrants from using *Zm* caused perpetual environmental conflicts in Dambakurima. The above statement cements the idea that social exclusion is also a result of historical considerations, not merely assumed social discriminatory tendencies towards societies. Lakerveld *et al.,* (2015) asserts that eco-resources do not just flow to human beings from the ecosystems; they are a result of the co-production of technologies, capital and human input. This shows that *Zm* as non-human actorcannot reveal what services it offers as a separate entity. Instead, its service can only be understood from relation approach, as explained in ANT terms. Whilst it can be viewed from a specific livelihood context, *Zm*, in essence, is a product of the interplay between various actors that include physical, knowledge, human and institutional actors. *Zm* alone cannot explain its ecological importance in terms of adaptive capacity and resilience in Muzarabani; it is part of a large complex web, since an array of actors is enrolled in the explanation.

Social capital plays a significant role in ensuring social linkages in a society that differs considerably among diverse human actors.In addition; it can also have significant impact on the livelihoods, resilience, development and resource management of a specified community. Respondents from the study site briefly touched upon these differentiations when referring to the original inhabitants, the *Vakorekore,* and their ability to claim ownership, circumventing regulations and investing power or capital to get greater benefits from *Zm* resources. However, there are other types of social capital that are involved in giving actors access to *Zm* and the benefits they can get from these wild fruits, such as associations that create rules, conventions and laws. There are other relationships among different actors that aid in developing networks (Neumayer, 2005). In support of this view, Musavengane & Simatele (2017)'s research done in South Africa observed that bonding social capital is evident in connecting and covering rural community actors. Bridging social capital that enhances inter-community linkages and cooperation among communitiesand institutions are also critical components of successful local natural resources management.

Increased household resilience from *Zm* harvest is only possible when the minority ethnic groups in Dambakurima are able to access *Zm* and other natural resources as an eco-based coping strategy; otherwise, it is just another mechanism for the local indigenous group and the intermediaries, to benefit at the expense of disadvantaged ethnic groups (Lavigne Delville, 2003; Meinzen-Dick & Pradhan, 2013). Confusion about the roles of diverse actors, poor actor networks, misunderstood existing forest laws, inconsistent enforcement and poor communication is disproportionately harmful to the poorer rural populations trying to benefit from *Zm.* This will further increase existing inequality unless pro-poor policies are taken on board. However, a study by Wiersum & Shackleton (2005)suggests that social capital can render

a solution in this scenario, as socially subordinate sectors often depend more on local eco-resources, despite facing greater challenges to access such natural products. Other researchers like Simatele (2010)and Moser &Satterthwaite (2008)are of the opinion that social capital is increased, through supporting or strengthening social institutions and actor ties and has been suggested as an avenue of increasing livelihood and socio-ecological system resilience. There is, therefore, an urgent need for the integration of *Zm* in the semi-arid rural development and the overall sustainable natural conservation discourse.

The case study revealed that the linkages among *Ziziphus mauritiana* and various actors can be enhanced using Actor-Network Theory (Neisser, 2014). The study recognises the social process and access to eco-resources as an ambit of the literature on resilience and livelihoods. However, the study's contribution, pivots, on the argument that the uses and distribution of eco-resources can be better understood if all actors whether human or non-human, are recognised. In addition the study illustrates that the benefits of *Zm* are not always the same. Furthermore, the study's findings show the strength of Actor-Network Theory, specifically the relational ontology. In terms of ANT, the study identified different actors and recognised the specified contribution of their role as agents. Access and distribution of *Zm* was demonstrated well using the interactive platform that exists in Muzarabani. The study further reveals the ANT approaches by emphasising the role of power and cultural controls which are normally its handicap. The complex web of linkages by actors in Muzarabani needed multiple theoretical explanations. Understanding the diverse actors that interact with *Zm* called for a multi-sectoral approach, making use of different theoretical approaches that factor in the role of diverse actors.

5.2 Institutional Arrangements and Challenges affecting *Zm* governance

The major hindrance to the existing institutional framework strength is a lack of well-structured coordination and supremacy over certain institutions. It is documented that non-governmental organisations and international organisations dominate the use of natural resources and government decision making through their financial influence (Wollenberg, 1998). The indication from 86.1% of households asserted that the non-existence of sound clear institutional structure is a hindrance to sustainable effective natural resource governance. In context, the roles of different institutions are not spelt out clearly. Other institutions queried the dominance of EMA over issues to do with natural resource management or governance. Response from key informants like Agritex was concerned with the way that only one institution, EMA, is praised over the environmental issue, as if it operated in isolation. However, there is need to acknowledge the efforts of other institutions even if EMA has the mandate to oversee environmental management issues. Lack of clear roles in diverse institutions also confuses the local people, as they are often given conflicting orders by these institutions. The geographical location of institutions like EMA and FCZ leaves a lot to be desired. The response of 70.2% of households complained that these institutions were absent when it mattered most. Other respondents though for 6.2% household suggested EMA and FCZ decentralise its operation further to ward level for them to be effective in natural management issues.

Different fees charged for the same offence were handled in a diferent way by institutions such as the traditional leaders, MRDC, ZRP up to EMA. The same offence carried a different fine depending on the institution claiming the charge. Fees from EMA, ZRP and traditional leaders

were not uniform. However, other institutions like AGRITEX and NGOs do not concentrate much on environmental offenders since they claim their mandate is to increase agro-ecological productivity. Locals in Dambakurima tended to follow advice from an institution that promotes the use of *Zm* for their benefits without taking into account sustainability issues. This explains the reason why traditional leaders and politicians top the list regarding popularity among *Zm* users.

Environmental committee members were viewed by 30% of the respondents as a unit selling out, who only drive the agenda of outside actors like EMA at the expense of the Dambakurima community's livelihoods. The main reason for the mistrust by the villagers emanated from the failure by the committees and EMA to give the locals' space to air their concerns. This state of affairs resulted in some members failing to cooperate on issues to do with environmental management. Popularity views and actions by politicians and the councillors at times unite efforts of institutions like EMA and MRDC. During election times it was pronounced that access to *Zm* was free for all. This resulted in the tragedy of the commons, *Zm* production has been reduced during this period because no one cares and controls. Political goals overrode the natural resources management agenda. The study revealed the easy access and readily available source of income from *Zm*, led to their overexploitation even in the wild forests far from their homesteads. Within the same context, reports from FAO (2012) indicated that the coverage of forests in sub-Saharan Africa is decreasing extensively due to human and environmental pressure. This loss and degradation of forests has been fingered out as one of the main reasons of the continued disappearance of wild fruits species in most developing nations including Benin as reported by (Segnon & Achigan-Dako, 2014). Evidence from the study shows that *Zm,* though under threat due to overexploitation, is not showing signs that will lead to its extinction. Based on the finding of this study, there is evidence to show that *Zm* is being threatened, and this is likely to leadto a crisis, that will threaten the livelihoods, food security and resilience of the Dambakurima community particularly where domestic consumption is more prevalent than *Zm* trading. This situation is similar to what Place & Meybeck (2013) discovered in their seminar paper in which they investigated the relationship between overexploitation of natural resources and food security.Balancing the impact of natural resource exploitation and environmental management is a vital factor for enabling resilience and food security

There are institutions that were key in Muzarabani; however, there are some officials from these who are not well versed with policy issues. For example, MRDC officials do not have specified rates for traders that take *Zm* outside Muzarabani. Different traders were levied different amount depending on who the official is and what their personal estimation is on that day. There are no instruments used to measure the quantity of *Zm* that one has. This has promoted corruption and discarded ways of governing *Zm* in Muzarabani. This has also fuelled conflicts and mistrust among traders, locals and the MRDC. Smith *et al.*, (2010) similarly argue that sustaining the contribution of eco-resources to food security and resilience hinges on the ability of concerned institutions, mostly in developing nations, to protect, improve natural resource governance and ecosystem health in the face of increasing environmental challenges (floods and drought).

5.3 Institutional structural changes and the future

Challenges identified were a result of poor linkages, coordination and the mutual relationship among institutions. The majority of household heads, 91.2%, indicated the need to change the available institutional framework as supported by (Quandt *et al.*, 2017). This can only be achieved when actors are identified and the issue of *Zm* production is problematised (all actors know the challenges of poor natural resource management and its effect on resilience)(Ming'ate, 2016). All actors and institutions network and push the same agenda, sharing the same vision and pulling resources together (mobilisation for the benefit of the environment). Actor networks might be more key than the presence of formally known institutions for, amongst other issues, real enforcement and agreement with environmental rules. However, networks also come in different structures, and their actorshave a variance in governance conclusions(Bodin *et al.,* 2006). This will ensure all institutions are treated fairly and their input respected without fear or favour. Tantoh & Simatele (2017) in similar case studies revealed that until rural inhabitants are given the right to run and manage their own natural resources affairs, with backing from various institutions, effective and sustainable natural resource access and usage will deteriorate and the resource(s) base will continue to erode. Actor networked systems of resource use, governance and management must be supported, given voice and financial aid intended to benefit the poor (Simatele & Etambakonga, 2015; Tantoh & Simatele, 2017). In the same light, Mubaya & Mafongoya (2017)emphasised the role of actors' networks in natural resources management with the results cascading to other districts of the country.

The establishment of local training institutes for the environmental committees' members would promote capacity building and thereby enhance information dissemination of eco-resource management and conservation. The environmental committee members who are trained would, in turn, execute their duties professionally rather than the current scenarios where volunteers run the show. Locals should also be given lessons on the diverse roles of different institutions (local or external). This will ensure a sense of acceptance and commitment on the part of the locals since they will be aware of the roles of institutions operating in their area. The creation of platforms, where all actors are invited and their mandates spelt out, and agenda and vision laid out is a necessary step towards the coordinated approach of natural resource management. Actors to form the platform should include, but not be restricted to, EMA, locals, FCZ, ZRP, MRDC, traditional leaders, political leaders and NGOs.

The role of *Zm* governing institutions, their relationship with institutional frameworks, managing *Zm* access, ownership, utilisation in Dambakurima village of Muzarabani Zimbabwe, were explored and analysed in this chapter of the thesis. The participation of different actors varies depending on their visibility, level of presence and commitment. The results finally showed that multiple institutional frameworks regulated ownership, use and management of eco-resources like *Zm* in rural spaces needs the identification of actors, their roles and networks to support resilience efforts.

5.4 Applicability of ANT

5.4.1 ANT and the Dambakurima case

The findings from this study reflect that to achieve eco-based resilience more actor engagement is needed to devise solutions that address the challenges faced by the rural poor in areas prone to natural hazards. In addition, the solutions should also address contrasting benefits that exist amongst diverse actors and the environment. This will guarantee that future generations will derive similar value from *Zm* as the existing generations do. In Zimbabwe, the network effort is essential from a political viewpoint to ensure environmental regulations and rules that can be enforced. Various institutions and actors exist and some thrive in questionable environments that reveal a reluctant approach towards matters to do with the environment.

The researcher's aim was to add significant scholarship research regarding semi-arid regions. Emphasis is on how we could think and examine 'ecological' and 'social community' in the context of resilience and livelihoods in the semi-arid region. The recurrence of hazards in Muzarabani highlights the need for an alternative and more refined view of the links between actors that are human and non-human, as natural hazard mitigation becomes more complex. In this Chapter, the emphasis was on the undistinguished importance given to the *Zm* which can offer uncomplicated yet thoughtful re-attraction of everyday livelihoods and resilience landscape. The chapter has outlined how the ANT approach can usefully inform resilience and livelihood strategies and the importance of eco-resources in the discourse. Some approaches are given that could help conceptualise resilience and livelihood in Muzarabani. The significance of the ANT approach hinges on a more complicated approval of the multiple and fluid environment of reality, the analysis of the dynamic role of *Zm* in determining social interactions, and a hypothetically conversant approach to conducting the study. Gender issues and the importance of *Zm* in Muzarabani livelihoods and resilience landscape are discussed and argued in the chapter. The study concludes that the ANT can provide an alternative methodological approach that could enhance the understanding of resilience and livelihoods in a semi-arid region from an eco-resource based perspective. The ANT approach helped to percieve that the approach of certain radicals cannot be the panacea to epistemological arguments; conversely, it can aid in comprehending social practices and how diverse concerns occur in special spaces.

The study has demonstrated that the use and distribution of *Ziziphus mauritiana* plays an important role in determining livelihoods approaches in Muzarabani. The Chapter further reveals the role of various actors engrossed in *Zm* networks and livelihoods. The semi-arid region of Muzarabani is characterised by poor people living below the international poverty datum line of 1, 25 USD$ per day. The study concurs with the common belief that poor rural folks rely on diverse livelihood portfolios and eco-resource products like wild fruits are on the list. In the case of Muzarabani, *Zm* contributes significantly to the community's generated income, and for some families' substantial income is generated. In sub-Saharan Africa, a sizeable number of rural communities rely on wild fruits when affected by environmental stressors (Shackleton & Shackleton, 2004). It should be noted that efforts to revive the effective use of *Zm*in the area of eco-resources in the northern part of Zimbabwe will only thrive if complemented by a radical change in the assembly of power and governance of eco-resources. Consequently, various actors (human and non-human) must be recognised and considered on an equal footing in the

identification of problems that affect their communities, for example effects of climate variability and development of strategies.

The study revealed that *Ziziphus mauritiana* distribution is better explained as a function of specific inter-related varied actors that encompass human and non-human. The Muzarabani case is unique and cannot be a replica of SSA eco-resource-based societies. Neither can the Zimbabwean rural communities, dependant on wild fruits as a livelihood, be generalised. Empirical evidence of the study denounces the idea of generalising the Muzarabani case. On a closing note the study reveals vital theoretical and methodological considerations for research in the field of eco-based resilience and livelihood in semi-arid regions research. The study also suggests that eco-resource wild fruit studies can be analysed with a different lens to unmask the complex interactions at play. The ANT lens being radical can explore the often overlooked eco-service management process. The study suggests the field should take an actor network process and context-orientated approach.

Many scholarly works have failed to recognise the importance of diverse actors, let alone insights to inequities relating to eco-resource use and resilience. Most literature on eco-resource has prior assumptions of the eco-resource and people relationships. The study argues that there is a need to critically analyse such misleading assumptions. For example, stating that wild fruits benefit all poor members of the community. The Muzarabani case proves otherwise. Benefits of *Zm* are not equally distributed among the Muzarabani community. Wealthy actors at a local, national or global scale tend to be powerful and well connected and benefit more from the *Zm*. Supporting the understanding of ANT that power is all about how well one is connected, not the distance or the physical power we talk about daily. The well-endowed actors benefit more from *Zm*, despite the fact women and children are the daily managers of the *Zm*. It must be noted that some members of the Muzarabani community do not benefit from *Zm* for various reasons.

The study argues for policy perspective that equity, being a fundamental principle of sustainable development and human welfare, should form the basis of the agenda for eco-resource and livelihoods research. First port of call should dwell on the actor's identification, understanding of relationships, their activities, and networks to effectively address the existing inequalities in the use of *Zm*. Taking note of the results from Muzarabani, the study argues that it is misleading and failing to assess eco-resource-based livelihoods from the international or regional perspective. According to Agrawal & Gibson (1999), some livelihoods approaches are based on international eco-resource management approaches that are not applicable in some situations. The study buys the above argument and suggests that black boxing the eco-based research is not always locally appropriate and may move in contrast with laid down local agenda or activities.

The study findings call for eco-resource, adaptive and resilience research to be situation specific, actors and benefits-orientated, which in retrospect counters the gaps between existing eco-based literature. The study established that social and ecological distribution cannot be accounted for or described by a simple single approach; instead, it requires multiple radical methodological approaches. ANT's use was not meant to debunk the black boxed known eco-resource, adaptive and resilience studies, but to contribute to its literature. In particular by demonstrating how ANT can influence the way we may view eco-resource, resilience and livelihoods. In a nutshell, ANT enhanced our understanding of *Zm* rendering diverse means for action.

The case presented here offers empirical, conversational evidence for a rural eco-based community on the conception of adaptation and resilience, building from ANT's teaching on actors and networks. This approach holds the great diversity of the world's rural poor people and recognises the multiplicity of actors in natural hazard-prone landscapes. It affords a comprehensive and integrative way of accepting how varied local actors who use *Ziziphus mauritiana* demand equal distribution, participation, recognition and a quest for the basic resilience of communities. In Muzarabani of Zimbabwe, and around the globe, rural poor people demand that eco-resource may originate with privileges for distributive and practical fairness, but the discourses of the wild fruits quickly transfers into wider issues of actors' capability and networking. The full comprehension of contemporary claims and dialogues entails that the conception of adaptation and resilience must address the central capacity of local rural poor to sustain their eco-based lives and livelihoods that are of significance, for example, *Zm*.

Consequently the approach of using ANT is convenient, in that it climaxes the diversity of actors tangled throughout the *Ziziphus mauritiana* processes. Differing from St. Martin (2005)contentions that the cartographies of eco-resources science are barren of social, community or cultural processes, this methodology shows indirectly that the processes exist in the cartographies.

5.4.2 Unpacking the Eco-Based Resilience Black Box using ANT

Given the prevailing situation in Dambakurima in relation to resilience and livelihoods during extreme weather conditions, there is the need to rethink alternative efforts. What is required is an understanding of resilience and livelihoods in the semi-arid region from the local context perspective. This consideration should embody both a social-ecological system and knowledge. Resilience against hazards through mitigation strategies is traditionally assumed to be the responsibilityof the government and non-governmentalorganisations' responsibility, such an approach used in this study is a "Black Box". ANT has used the term Black Box to explain how objects or non-human actors operate in different systems for example, machinery (Callon & Latour, 1992). A Black Box could be a laptop, a radio, a policy or any other object that should operate as expected. When this happens, complex relationships (social, technical or ecological) could be considered (Black Boxed) or unseen (Linde *et al.,* 2003). The concept which has its origin in information science was used to explain how complex processes operated. In sociology, it was taken to mean the unquestioned way of doing science as the objective truth. In the context of resilience and livelihood studies, the Black Box refers to responsible communities or actors that appear obvious and self-explanatory to the viewer, for example actors in theprovision of food aid, relocation or roadreconstruction by the government or relief organisations following a hazard.

The fundamental questions for this study are: Howcan the resilience and livelihoods Black Box of Dambakurima are unpacked? What should be the focus? Looks to be quite an impossible task. However, this is made possible by moving in space-time discourse until the issue of resilience is resolved. This can be achieved through the identification of useful local eco-resources, for example, *Zm*, not only through the known assumed approaches. This part of the chapter presents an eco-based framework of rural people intensification and environmental prospects, making use of current findings in theoretical domains to scheme a focused social-ecological

resilience analysis. The first task, as shown in Figure 5.1.1, is focused on the factors that influence resilience. Secondly, the SLF is presented as a Black Box through the use of ANT, meaning it is given a model with prescriptive and set rules believed to be the known way to livelihoods and resilience (Figure 5.1.2). Thirdly, the unpacking of the Black Boxed resilience package shown in the flow chart of Figure 5.1.3 is engaged to offer new insightsinto the discourse of resilience. The opening of the Black Box is based on the recent research on the interactions of *Zm* and other actors with smallholder intensification in mind with particular attention to the benefits that enhance resilience. The final part of this Chapter addresses policy insights arising from the interlinks of *Zm* and other actors towards achieving the processes of eco-based resilience.

With regard to semi-arid rural household level resilience, the existing literature focuses on highly agrarian developing states, where natural hazards have the possibility to worsen poverty. According to the SLF model, quantity and type of assets (Natural, Social, Economic, Physical and Human) appear to be important in defining the amount of damage and time of recovery, with a higher focus on productive assets as the most operational asset portfolio (Solesbury, 2003; Berman *et al.,* 2014). There is academic agreement on the significance of diversification to livelihoods with particular access to off-farm activities as an approach to build resilience and reduce risk (Quandt*et al.,* 2017). This is directed to the question of whether certain general properties can be identified in rural communities that would improve resilience over time and in given contexts or not. It is no exaggeration that resilience of a community is latent, and only once unpacked, a community is subject to stress or according to factors listed in Figure 5.1. as supported by (Mccord *et al.*, 2015; Ebhuoma & Simatele, 2017). The uniqueness of place, scale, and specific nature of capital frameworks also creates complications when attempting to simplify a set of key factors which enrich resilience (Vincent, 2007). This is mainly where thinking of rural communities as complex adaptive or resilient systems proves useful. The ANT thinking literature contains generalized properties that have the potential to contribute to actor networked resilience understanding. As resilience is experienced locally and daily for government and international aid institutions, it can be regarded as complex Black Boxes that hinge on known materials, techniques, behaviour and processes.

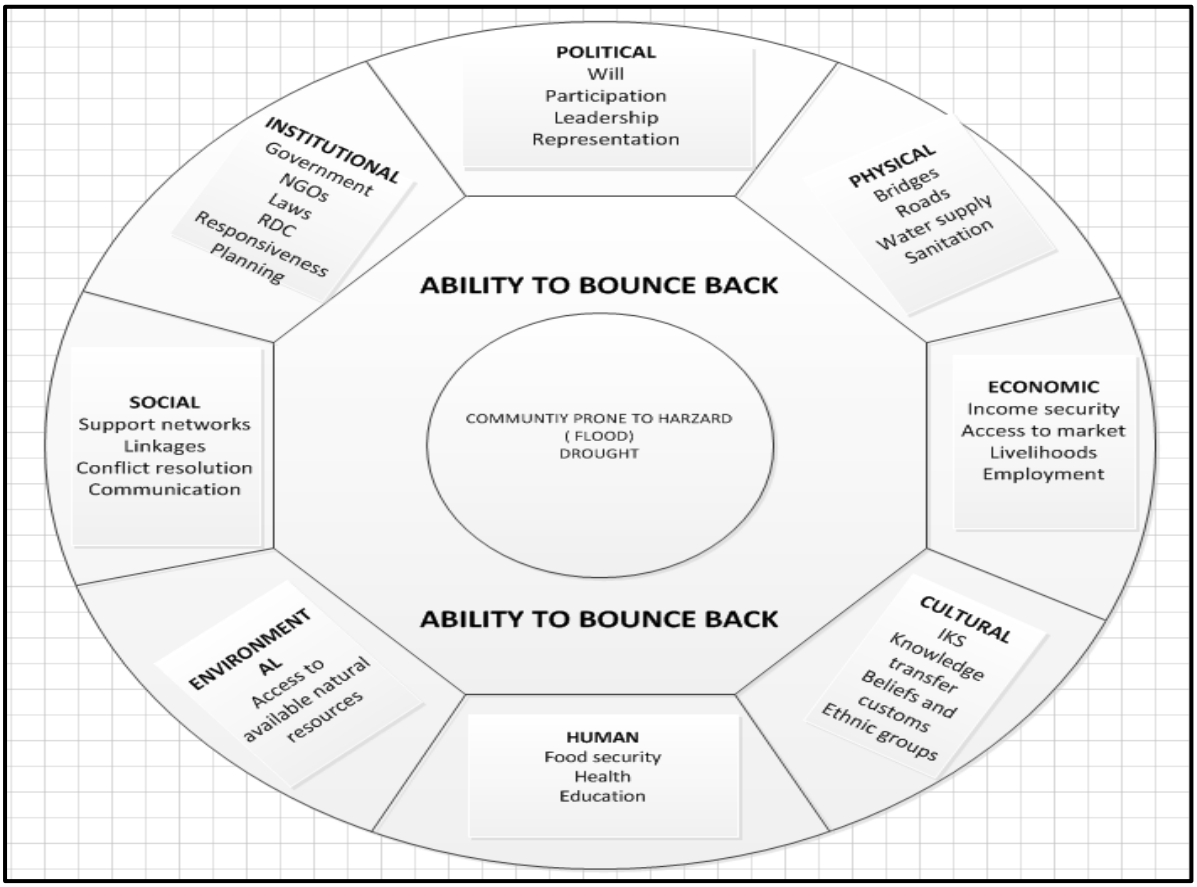


Figure 5. 1: Key factors influencing resilience

Source: Field based material. (2017)

An introduction to the resilience Black Box leads the road to an inquiry of the avenues in which a range of social features and resilience aspects are linked in order to produce a durable whole, see the flow chart (Figure 5.2 and 5.3). Methodologically, ANT allows this study to invite all actors who may contribute input to resilience discourse of Dambakurima and similar rural settings. The actors could be human or non-human such as academic scientists and engineers, or institutions such as government (Environmental Management Agency), the private sector and non-governmental organisations (Southern Alliance for Indigenous Resources).

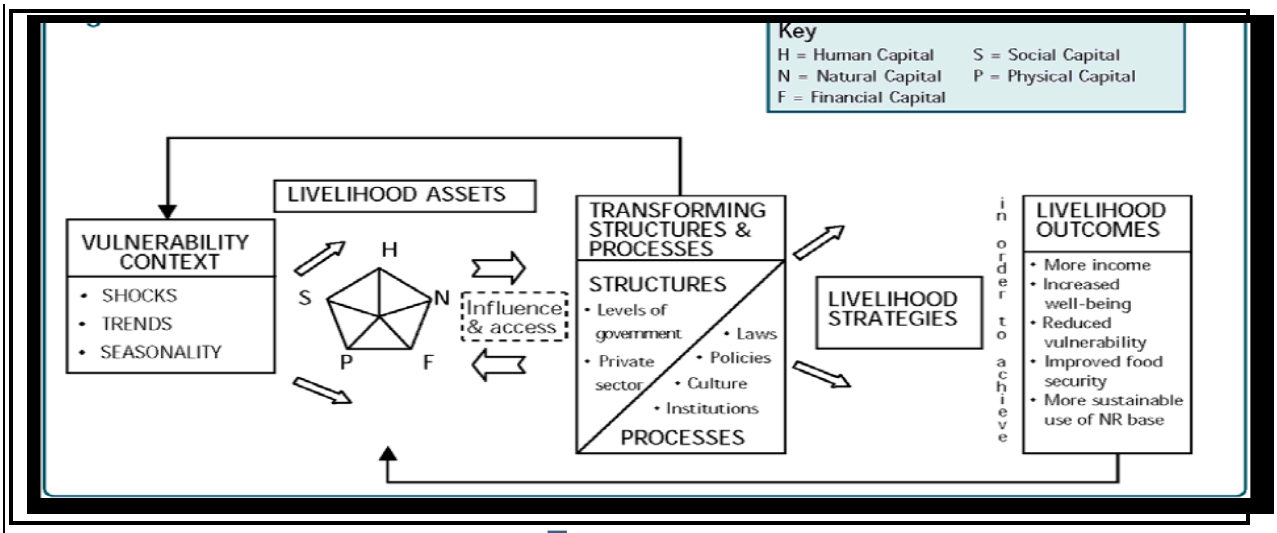


Figure 5. 2: Black Boxed Sustainable Livelihoods Framework

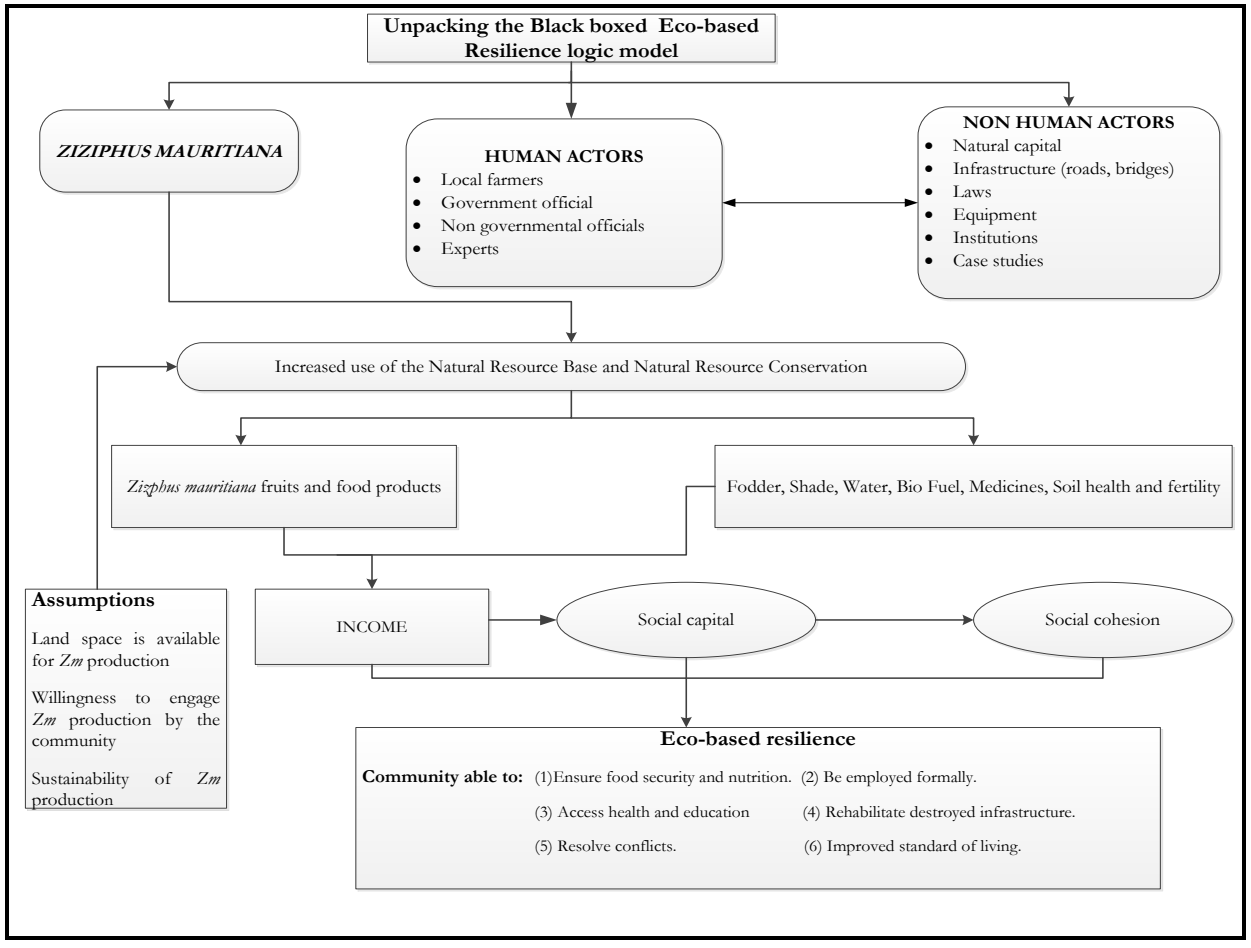


Figure 5. 3: Actor Networked Eco-based Resilience Logic Model (ANERLM)

Source: Field based material. (2017)

These are the same actors identified in this study that are lacking inter-relationships to help build resilience and livelihoods of the Dambakurima community. The proposed model in Figure 5.1

suggests the process of explanation and juxtaposition, technical or expert innovation can exert guidance over the eco-based resilience trend and trajectory. In this respect, ANT displays the importance of recognising all actors (non-human and human) as equal actors in any process. Local level studies of the available eco-resource (*Zm*) and other actors have influence over the resilience trajectory. It is suggested during the building resilience course, these actors are not meant to shape resilience or new ideas apart from the social-ecological world. Instead, they must persistently re-define a socio-ecological world. In other arguments, the separation between the scientific and resilience is cancelled when we analyse deeply the process of resilience improvement.

The ANT approach guided by Neufeldt *et al.,* (2009) suggests that the actors involved in the resilience discourse will be addressing social and eco-technical challenges at the same time, and this would only input new technology. However, the rural social structure and resilience would radically change. The proposed design approach would call for experts and locals to simultaneously address the social and technical challenges of improving *Zm*, as a viable eco-resource. The process arising herein is named: Actor Networked Eco-based Resilience Logic Model (ANERLM). Large-scale eco-technological innovations (such as introducing new *Zm* varieties using high input machinery and experts) and the expansion of land for *Zm* production are a function of the links of diverse actors as these are shaped and integrated into a resilient network through ANERLM. *Zm* has proved to be a successful wild fruit tree for semi-arid spaces in Africa. *Zm* is also widespread throughout the Muzarabani District, thriving on different types of soils and occurring in semi-arid ecosystems. This fruit tree requires an academic inquiry to enhance its production and expose its potential resilience benefits. However, it should be noted that for one to comprehend the process of socio-eco technical creation, guessing would avoid limiting oneself or the community to one perspective (politics, ecology or economics). Instead, there is need to understand all actors contributions to resilience efforts. By using ANT, the mentioned term separates itself from other theories. As explained, ANT thrives to have a balanced account of the social, ecological and technological world, in respect of understanding how and why we have the current resilience approaches. Furthermore, the research aims at how we can enhance the understanding of the prevailing resilience approach. All these centre on considering all actors as equal (human and non-human).

The social in the process of innovation, however, should not in any way be given privileges (Ernstson, 2008). It should not be regarded in isolation or behind the system building resilience. Other actors may play more critical roles than the social as in the case observed by the study. Other actors or factors, may better explain the shape of resilience and livelihoods after a hazard, in respect of the prevailing social structure. In ANT terms, its focus on the eco-technical box, how the emergence of innovation is conceptualised and the actors are involved have been explained. What is left is the explanation of the missing link in the process of innovation and maximisation of *Zm* productivity. The term "translation" seems the answer to the above question. In the methodology Chapter 3, it appears innovation and expertise alone cannot be assumed to stand outside of the social-ecological world. Innovations and expertise are characterised by different social, ecological, cultural, political and economic traits and particular stories attached to them. The eco-based resilience system conceptual framework provided, acknowledges that the various factors, outlined in Figure 5.1 (that includes the biophysical

processes), and at times their commonly unequal benefits to local humans are mediated through political procedures.

Translation is meant to forge linkages and communication among diverse actors in any process. Resilience as a process requires translation, which simply means its improvement is brought about through inter-relationships amongst different actors. In ANT language, translation is an idea that connects the gaps amongst the diverse elements that are combined through the resilience process. Translation comprisescreating unions and shared vision by interacting actors that have different views on a challenge or solution.For example, the case of Muzarabani where different actors have different views on using *Zm* as an alternative eco-based resilience approach.Translation is the route by which these actors are interlinked in social-ecological technical network terms. It is the process through which actors are identified, followed, networked, and the boundaries of movement are delimited and discussed. In the Dambakurima case, translation should be considered as the general movement of resilience improvement over time. In addition, the questions of how to make sense out of *Zm* are turned into an academic research laboratory. How are all the ethnic groups in Dambakurima, institutions, officials from government and non-governmental organisations shaped to consider the same thing that experts believe? And lastly, how are the uses of *Zm* able to transform the resilience and livelihoods efforts? ANT unpacks the concept of translation into five stages namely: Problematisation, Interessement, Enrolment, Mobilization and Stabilisation (González, 2013; Latour, 2005). In context, problematisation refers to a point where all concerned actors in the eco-based resilience approach identify the need to change the existing relationships of the known resilience networks. This is normally done by the humans, mainly because the humans communicate better than the non-humans, however, it should be acknowledged that the non-human actor like the *Zm* facilitates the problematisation process. For example, this study uses the problematisation of resilience process. All actors need to understand the effects of floods and drought in Muzarabani. In the same vain all should be willing to find solutions for recovery. However, problematisation is expressed by experts who are openly connected to viable local eco-resources e.g. *Zm*, an actor considered non-human. Meanwhile, all actors should congregate around the prevailing resilience framing and then participate in specific dialogues within the context of such outlining. Such dialogues will result in ordering diverse actors with the focal actors playing a pivotal role in directing the process.

Henceforth, with all the diverse actors that are involved in an Interessement with the main actor, produces a stabilised network.Interessement as defined by Callon (1986), is an assembly of actions by which an entity attempts to impose and stabilize the identity of other actors through its problematization. For example, the rules, regulations and legal documents that support the use and management of *Zm* in a country expect diverse actors to play their specific roles. In context, responsible actors sanction the rules, regulations and policies that govern the use of *Zm*. The locals and external actors follow the set rules and minimise conflicts emanating over the use of *Zm*.. The stage that generally follows is enrolment in the next stage, interested actors are made to consent and execute certain roles. The subsequent stage is the interessement which ensures successs of' enrolment (Latour, 2005). It is at this stage where actors who are for the idea of eco-based resilience will try to form agreements surrounding 'discussions, give and take' and the problems the actor experiences in this process (González, 2013).The realisation of the

importance of the eco-based resilience approach is made possible by the enrolling allies' process. Actors can assemble the required resources to sustain their preferred eco-based resilience network in the context of the *Zm* network. Enrolling is a predominantly stimulating process by which diverse actors consult other concerned actors in their own intervention or activity. Actors' relationships are defined by mediators passing among them (Callon, 2005). The fourth stage is mobilization, which sustains a commitment to the problematized resilience course of action. All those mentioned are actors that can contribute to the improvement of *Zm* production in Dambakurima, the mobilization stage can be understood as a test assumed to the actors to verify whether other actors stick to their words or not (Law, 1992). This form is also applied to the actors regarded as non-human equally well. The association for the various actors in a network when successful can realise a temporary stabilisation. However, in the process of translation failure or disturbances can occur at any of the above-described stages. Yet the translation of the interests in diverse actors, along with their enrolment into stable networks, requires continual chains of translation. Callon (2005) describes these processes, actors, their complexities, expectations and uncertainties, as often concealed within 'Black boxes'. The Black box is a representation used in ANT terms to characterise a complex classification. Black boxes resist change and take actors, networks, objects and processes for granted. The existing resilience and livelihood strategies in Dambakurima after floods or drought include: food relief from the government, non-governmental and church institutions, as well as rain-fed agriculture. Dependence and many other strategies unearth a trend to oversimplify the local complex context of resilience in a semi-arid space.

Another term that could help explain the proposed framework shown in Figure 5.1 is delegation. Having identified actors, there is the need for delegation of duties towards the same vision. People act not out of choice in some instances, but because some actions are linked with innovation that delegates duties within a social-ecological technical network. Hence, delegation is another element of translation whereby the political, social, ecological, technical or innovation elements interlink and organise each other. There is no room to separate any entity from the process of improved resilience and livelihood efforts in rural spaces like Dambakurima. In conclusion, an ANT lens can possibly be used to ameliorate the understanding of resilience options of semi-arid spaces.

The underlying questions of how and why in semi-arid spaces like Muzarabani, the resilience strategies can be explored. ANT develops the research path that explains the complexities surrounding the local resilience and livelihoods efforts. The aim of using the ANT lens helped to unearth that eco-based resilience, livelihoods and income of semi-arid rural households are shaped by the extent of actors' relationships. In addition, ANT aids the understanding of these relationships and improves them to enable communities to recover after a natural hazard. The actor networks help communities to effectively use available natural resources and pay less attention to external interventions which are known to be delayed and insufficient. Resilience is enhanced as communities get improved access to household or community income, food, medication, education, livelihoods and the ability to rehabilitate physical infrastructures from the natural capital. This is supported by Peacock (2014), when he states that an ecological resilience perspective is critical to considering community network processes. Hence, it is important to note what is critical when addressing the resilience abilities of a community as a network of

interacting social systems. The issues to note include: the differences, complexity, competition, control, coordination, conflict, as well as inequity over resourses access and uses. For instance, when considering post-disaster Hoya Bridge recovery see Plate 4.4.there will be a number of activities and roles that must be assigned to the many different Muzarabani households to address the renovation of the bridge. At the rural community level, these activities will include financing, provision of labour, procuring of materials, expertise and coordinating the activities of multiple actors among others. The main point is to consider the community's capacities for resilience related issues, such as rebuilding and recovery efforts after disasters There is a great need to reflect on the Economic capital of the community that can be based on its Natural capital base, in addition to the input of various actors that include: organizations, professionals, and assemblies that can enable these processes.

5.5 Implications

The study offered optional policy interventions that could be used in the climate change adaptation discourse. The complex human and non-human actor interlinks are shown at multi-scales. This entails interaction between communities and their available natural resources. The degree of control of the resource is shaped by the interactions of diverse actors. The actors that control can be individuals, households, communities and formal institutions. The interaction of these actors, based on consensus in decision making, provides a productive environment for adaptive intervention.

Adaptive and development initiatives should base their efforts on the participation of communities in the use and management of local natural resources. To build indigenous norms and capability there is a need to embrace gender, and eco-resource networked approaches that guarantee natural resource management, processing and marketing. Development agendas should include and acknowledge the agency of indigenous actors in natural resource governance and their capability to ensure adaptive livelihoods approaches.

Actors' identification and understanding of their linkages with natural resources conservation, economic connotations, and food security issues are important. *Zm* has the potential to offer unexplored benefits to the Muzarabani community. This can only be achieved through aided natural production regeneration that can be sourced through actor networking. The local knowledge combined with contemporary research can also be used to enhance the understanding of ecological growth in semi-arid regions. Bearing in mind the significance of *Zm*, there is a call to research more on wider natural resource conservation, trading and sustainable utilisation including decision making precesses in the complex system and network of actors.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

In this chapter key findings and teachings that were learnt from the use and management of *Ziziphus mauritiana (Zm)* in the context of climate change adaptation in Zimbabwe are brought together. This is in line with, the search for the actors and their linkages in a bid to enhance rural livelihoods and food security. The chapter has five parts: the first part recaps the main findings in line with the aims of this study. The second part explores the study's limitations. The third part highlights the theoretical limitations of using ANT. Lastly, the fourth part focuses on the proposed recommendations and the last part suggest future research, focusing on rural semi- arid spaces.

6.1 Recapping Key Findings

The thrust of this thesis was to present a better understanding of the role of *Ziziphus mauritiana* (*Zm*) use and the ecological, social, economic and political dynamics shaped by its interaction with different actors in Muzarabani. This thesis provides specific evidence for how the *Zm* contribute to building resilience by enhancing the livelihood and food security benefits to the semi-aridcommunities. The study made use of the Actor-Network Theory (ANT) to enhance the understanding of how an eco-resource (*Ziziphus mauritiana*) can have a say in the resilience of a semi-arid region prone to the effects of climate variability.

Semi-arid rural livelihoods are traditionally dependent on both the environment and agriculture. Hence, the two terms "environmental and agriculutural" are implicitly stated. These form the livelihood and resilience sources during extremely sensitive periods to climate change, which has diverse and converging special effects on both of them. The significant challenge that emerges from adapting to climate change in semi-arid rural areas in particular, has been the fact that adaptation efforts have tended to be fragmented in diverse actors pursuing different agendas. In other arguments, responses have tended to observe the non-recognition of local eco-resources as important actors, duplication of roles, and non-involvement of some key actors in the resilience and livelihood discourse. The argument here is that, what happens toone sector or actor can have both positive and negative feedbacks on the resilience and the environment and vice versa. For example, if there are poor networks of the Rural District Council and the community because of the non-recognition of different actor'sroles, it is likely that there is mistrust and over-exploitation of natural resources and increased pressure on the environment. Similarly, if environmental services diminish because of alack of actor networks or climate change, the pressure is also likely to increase upon the responsible authorities and agricultural land, particularly in drought or flood prone areas. Hence, the need to have an eco-based unifying logic model. As shown in Figure 5.3, the suggestedActor Networked Eco-based Resilience Logic Model (ANERLM) has the two following important components: the actor networked rural livelihood system, and the research livelihood, development component/system.

The rural livelihood system depends on the non-dependable rain fed agriculture and the wild natural resources like *Zm* or the environment. However, it faces a number of challenges such as climate change, and other multiple stressors such as poverty, diseases and natural resources degradation, and many others. The study and development component aims at helping finding solutions to overcome the challenges that rural people face such as climate change. Important flows within the ANERLM are three key aspects namely 'Actors', 'Networks' and 'innovation'. In terms of responses to challenges such as climate variability, all these aspects are important for successful adaptation. Innovation is an important enabler in climate change adaptation, as there is a need to formulate and adopt new ways, new eco-based techniques, new technologies, and new strategies in response to climate variability.Ensuring the reduction of the contemporary vulnerability of agro-eco based systems is complex, basically because of the result of the progression of systemic and complex actor's relations.

Unpacking these complexities, required the identification of; different actors and exploring their interaction with the *Zm* for the benefit of the Muzarabani community. The study used observations, semi-structured interviews, focus group discussions and reviews for official as well as unofficial documents to follow the actor(s) in line with the ANT teaching. The study demonstrated that *Zm* is a basis of food, beverage and income, although it is also a source of opportunity, and it is an alternative productive resilient approach through a variety of ways. It is fruitful of conduct, and uniqueness, and it is essential in the daily lives of the rural people in Muzarabani. *Zm* management and its cost (merits or demerits) had noteworthy implications not just for the Muzarabani community that produces *Zm* but for various other actors to which they are linked. Thus, in viewing the eco-based climate change adaptation strategies in terms of *Zm* production, scientifically or socially or otherwise, interest ought to be directed to *Zm* as an integral constituent in the Muzarabani discourse.

The study made efforts to show that *Zm* production, use and management is not all about "human" actors who are considered active participants and in control. In some instances, human actors are rather marginalised or assume passive roles in the entire process. This view poses some broader suggestions. First and foremost, variously related literature in sub-Saharan Africa for the past three decades, suggests that efforts at rendering widespread access to wild fruits or processing eco-resources would be feasible only through the integration of indigenous knowledge or craft and scientific contribution. *Zm* producers whose characteristics are dependent upon some understanding of tradition and experimentation have a role to play.

Understanding the institutional arrangements is considered the model solution for managing natural resources, and the ecological as well as the economic challenges associated with them. Despite this, consideration of actors and the institutional arrangements that govern the production, use and management of *Zm* is rarely an option for policymakers and researchers of semi-arid spaces. What the study has put forward is that issues of this nature are a result of relations of various actors. It has been shown that *Zm* producers are not merely caught up in power dynamics with government officials, traders, fellow villagers and traditional leaders. In line with ANT, the study demonstrated that the attributes are produced or performed by relations among actors. Various forms of *Zm* management result from un-noticed coordinating relationships among actors and the set of rules that exist and govern the established networks. *Zm* management is closely related to how the natural, social, economic and even the technical is

conceptualised. Thus, depending on how ecological, social and technical aspects are understood by various actors, *Zm* can be used and pursued differently at specific cases.

In this thesis, it is demonstrated that the considerable sum of work done by diverse actors is what holds the *Zm* producers. It is further argued, that the stability of the network mainly results from heterogeneity, in contrast to the size or quantity of relations among entities. Demonstrated in this study are the benefits derived from *Zm* by the Muzarabani community as a result of the efforts made by diverse actors (human or non-human). The community relies on intermediaries or *Zm* traders and an array of actors to obtain income, eco-services and various goods that enable them to withstand the effects of harsh weather episodes. Stability is realised through flexibility, and not only basing the relative size of the actor. However, the study kept in view the part played by *Ziziphus mauritiana* in food security and resilience. Wild fruits are just one constituent of the complex fabric of the semi-arid rural life, and resilience depends on a full range of factors apart from *Ziziphus mauritiana* and its products and processes

6.2 Limitations

The study has some noticeable shortcomings that should be acknowledged. Firstly, accessing first-hand information about diverse actors proved a mammoth task. While depending on interviews to inform texts is not totally challenging on ANT terms, the study's analyses could have gained more from face to face encounters with diverse actors, instead of the textual accounts that were provided where access to certain actors was impossible. The related setback is that basing both interviews and texts on the study denotes that the choice of actors carried forward is restricted to that which the research invokes. While interviews based on texts still expose how some actors attract others, the dependence upon texts is, however, one means where the scope of this study is restricted.

Time was also a limiting factor, since lengthier observation sessions in a larger number of study sites would have been desirable and added more depth to the information and consequently the analyses. The time limitations and the possible risks related to letting researchers with no *Zm* production experience participate in the practice excluded this possibility. In addition, since certain activities, such as the collection, drying and marketing of *Zm* only take place in certain periods and places. Given the one year time period for collecting data, the opportunity in observing (participating) in some of the processes, made it difficult for the research to fine tune all the details. This study may well benefit from a comparative element; the thrust of this thesis was only on how *Zm* has contributed to the livelihoods and how the community in question has used it in achieving relative resilience.

Having access to institutional places that had practised recent success or failure to visit would have enabled for better deliberation of how success or weakness is also shaped by specific relations. Nonetheless, an investigation like this was unaffordable for this study despite efforts made to contact institutions that have had such experiences. Actors are also incorporated into this analysis, making it an issue. At times some of the decisions on exclusion and inclusion are a result of the inaccessibility of specific spaces or in examining particular experiences (such as the *Zm* producers and the traders, *Zm* producers and the government, the researchers and the traditional leaders in the *Zm* processes).

It is argued with this thesis that *Zm* commodity chain networks have no beginning or end. Networks, by their nature, can be extensive, virtually endless; hence some networks and actor(s) might be excluded by choice as a way of allowing a reasonably delimited account instead of one that is endless. These choices, whether made unconditionally or openly, have repercussions for the nature of explanation produced, the conclusions that are drawn, and the actors included or excluded. However, the cost of these activities can be minimised slightly by bearing in mind that the primary objective of ANT is not to generalise and give universal justification, but to generate local, particular descriptions (Law, 2003).

6.3 The limitations of ANT

ANT like any theory has its own limitations. The few major ones as they relate to this particular thesis are addressed. Taking, for example, the fact that ANT has proved to be a useful approach to getting actors that are nonhuman, in different degrees, into socio-ecological analyses some of its central ideas, such as translation, favour an essential, often human, actor. Many accounts are based on some central actors like the government officials or managers, a "heterogeneous environmentalist" to get actors together (Latour, 2005; Law, 2003). This may be an EMA scientist in Muzarabani, Zimbabwe or an engineer as suggested by (Callon & Latour, 1981; Callon, 1986). This is regardless of ANTs stress upon networks that are decentralised and of ontological symmetry (Latour, 1999). Thus, while we acknowledge the importance of non-humans in many processes, there are general questions raised over, the degree to which human actors that can truly be shifted from an established focus.

The researcher, during his long stay with the Dambakurima village community, observed at *Zm* markets men and women carrying out different duties. However, in the researcher's account, there was neglect in terms of accounting for several gender interrelated points of view, and was not clear how ANT could possibly help in this observation given its position on matters of responsibility, (in) equality and (in) justice, (Murdoch, 2001). During the time of the research, most of the rural farmers found at *Zm* markets were female. These observations raise questions about gender themes, and whether ANT has a say about the improvement of understanding, possibly the patriarchal manner in which eco-resources are produced and traded in an effort to help poor people in rural spaces adapt to climate variability. In ANT terms it might be suggested that it appears misguided to pronounce that it is gender indeed that assigns women to the *Zm* retail side and men to the *Zm* production side, and it suggests that a better thing to do would be to observe the different relationships between actors (humans and non-humans) and their actions to explain the difference and clarify gender.

ANT's (debatable) success in clarifying the way by which scientific evidence is created, may not have a say, as to a great extent developing the latest understanding of *Zm* production, since it is typically understood as a process involving different actors or entities. This thesis argues that what can be achieved from ANT in expressions of *Zm* production and its contribution to livelihoods is less a philosophical shift in how *Zm* is understood. That is, a *Zm* producer can hold up an alternative (debatably) eco-based resilience based on the complexity of actor relations. These complex relations may include actors such as; legislation, *Zm* fields, rural communities, government, researchers, national eco-resources, climate adaptation and resilience grants. The emphasis of ANT in this thesis makes it a success in the present Dambakurima case, in spite of

falling short under a few of its other assurances. Bearing in mind some of the criticism of ANT (Latour, 1992), CCA was used to render the analysis support through an interdisciplinary commitment to developing a stronger ethical position.

6.4 Recommendations

Based on the above findings the researcher recommends the following to diverse actors:

i. The government departments such as the EMA and AGRITEX need a review of natural climate change adaptation and resilience approaches in semi-arid spaces that do consider available eco-resource as a possible resilient option is needed. Interventions in drought and flood-prone areas should be based from an environmental perspective, as the daily activities in communities are heavily attached to their eco-resources like *Zm*. This will cause honest interventions in times of need as well as environmental governance and preservation actions that are not fixed on the interest of the external actors but that consider the interests of the locals.

ii. *Zm* traders and beneficiaries at all levels should also reflect the total effects of *Zm* sourcing on the rural environment; an emphasis is placed on financial gains at the peril of the environment. With the increased demand for *Zm* from Muzarabani, for example, there have been numerous environmental problems (see Plates 4.1, 4.2 and 4.3), therefore, *Zm* traders and intermediaries also have a role to play to ensure sustainable utilisation of *Zm*.

iii. External actors including the government, traders and non-governmental organisations, need to reconsider the way climate change adaptation and resilience sustainability is described by allowing other actors especially the local decision on the tried and tested/best approaches to resilience and environmental preservation. They currently offer or interfere extensively with an uninformed position of these practices, and they direct decisions in their favour

iv. The party-political environment requires a rearrangement of the strategies towards the ecological space in remote areas like Muzarabani. In addition the political will should enhance the engagement of diverse actors that include non-human actors, like good practice elsewhere in the world where *Zm* is grown commercially and creates jobs and financial earnings for the rural people in semi-arid spaces.

v. The government needs to think through eco-based resilient approaches and getting different actors to contribute to climate change and adaptation deliberations at various levels

vi. Diverse actors such as the community, MRDC and the traditional leaders that directly or indirectly benefit from *Zm* can think of a shared social accountability and give extra back to the environment from where they draw *Zm* resources and not just offer unfavourable prices to poor rural communities. In context, they should be part of the rehabilitation actors of the damaged roads and bridges see the Plates 4.4 and 4.5.

6.5 Future Research Focus

Future assessment of *Zm* production and its contribution to semi-arid rural livelihoods may include an improved emphasis on the diverse actor's relation to the "producer"-"consumer". A more comprehensive examination of how these actors are reciprocally enrolled into different networks, if and how these enrolments add to the enactment of "*Zm* producers" could provide considerable insight into a part of the larger network which this study was unable to explore. This could embrace stronger questioning of the manner by which an eco-resource such as *Zm* is understood and linked with rural communities and other actors, either as a natural, social or technical or artefact. However, this thesis has contributed to the promising ANT body of literature on eco-resources, resilience and food security studies. In addition, the thesis provides support for the radical theory of ANT as a prospective way of exploring climate change and adaptation issues. Although there are shortcomings as well as challenges that require careful consideration and which might need a different exploration in a theoretical way so that the study can rise above these shortfalls.

A few concluding thoughts close this thesis. While *Zm* production, processing and management is considered subsistence in Muzarabani in terms of the cash economy and environment, *Zm* is widely used during the periods of extreme weather conditions and requires understanding and promotion in semi-arid space. However, presently, there are various methods of *Zm* management that results in an uncoordinated approach to meaningful eco-resource management. The *Zm* remains one of the most reliable sources of food, income and beverage in Muzarabani and is prone to environmental degradation due to the high demand for its products. There is, however, no guarantee that the *Zm* that provides relief to the people of Muzarabani will continue doing so, or that introduction of new ideas or new technology products will improve the rural livelihoods of rural locals. By maintaining and recognising various actors in the discourse of sustainably managing the *Zm*, even if significant financial benefits are not realised, presents a degree of heterogeneity by the *Zm* producers and other actors. The study argues that this produces durability in the relationships that assemble around *Zm* production for the benefit of the rural poor.

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FIELD WORK GALLERY



Picture 1: One of the key actors in Muzarabani is Zimbabwe Republic Police



Picture 2: Women selecting *Ziziphus mauritiana*for selling



Picture 3: Muzarabani *Ziziphus mauritiana* market



Picture 4: Muzarabani *Ziziphus mauritiana* market



Picture 5: Muzarabani *Ziziphus mauritiana* market



Picture 6: *Ziziphus mauritiana* storage behind the lady



Picture 7: Interviews with the community leader



Picture 8: State of the roads in Dambakurima village of Muzarabani District

APPENDICES

Appendix 1: Interview Questions for the Community Members with the Dambakurima community of Muzarabani, Zimbabwe



Interview Questions for the Community Members

Name…….....

Gender…….....

Age…….....District.....

1. What is the highest level of schooling or education you have received?
2. Where did you grow up?
3. How long have you been staying in this community?
4. What is your source of income?
5. Do you grow *Masau* trees?
6. How did you get started with the growing of *Masau*?
7. When was this?
8. Where do you grow *Masau*?
9. How is the *Musau* tree planted on your land? Is it planted with crops, if so which crops?
10. Do wild fruit tree species provide food for your household? If yes, what?
11. What wild fruit tree species that you have are most important to your livelihood during flood? (rank highest to lower)
12. Does your household belong to any tree planting groups?
13. Are there organisations/ministries that promote the growing of *Masau* in your community?
14. What type of promotions do they offer to help you produce more *Masau*?
15. How do you receive information on what better methods to grow *Masau*?
16. Where do you sell *Masau* after harvest?
17. Tell me more about the importance of *Masau* in your community during floods/ drought?
18. Where do you get help when you experience floods / drought?
19. What type of help do you get during floods / drought?
20. How would you describe the relationship between the organisations/ministries and the community during floods/drought?
21. How are you involved in deciding the type of help you need during floods/drought?
22. In your opinion what can be done to improve the way your community is helped during floods / drought?wild fruit tree species
23. Would you like to make any other comments about floods / drought or *Masau*?

Thank you.

Question Topics *Zm* production

Community Leadership

1. Describe your biggest challenges in growing *Zm* administration?
2. How do you think *Zm* production are making contributions to the community?
a. Economically? Socially? Environmentally?
3. Do you have a vision for the future of *Zm* in your community?
a. What are you doing to move toward that vision?
4. How can the community connectedness component in community gardening be better fostered?
a. Are there any plans to do so?
5. Considering competition for funds do you think *Zm* community gardening has enough funding?
a. What community activities receive more attention?
b. What possible sources for funding have been explored?
c. What would be required to go after additional funds?

Thank you.

Appendix 2: Interview Questions for the Organisation/Ministry Participants



Region …….....District…….....
Name……Job Title.....
Sex……Age……Education level.....

1. Would you please introduce your history with this organisation/ministry?

2. What is the mandate of your organisation/ministry?

3. I understand your organisation works with Muzarabani community, how many people does your organisation/ministry employ in Muzarabani?

4. Could you explain problems faced by the Muzarabani community during floods or drought?

5. What is your organisation/ministry's primary role in the preparation of drought or floods in Muzarabani events in Muzarabani?

6. What problems do you encounter as an organisation/ ministry when planning for ways to reduce the impacts of floods/drought in Muzarabani?

7. How have you involved other organisations/ ministries in your efforts to assist the Muzarabani community during drought/floods?

8. How do you as an organisation / ministry plan to improve the way how you plan for future drought/floods events?

9. Are there any national, provincial or local policies/strategies that your organisation uses to inform its decisions on the management of natural resources in light of drought/floods?

- How or when do you draw on these documents?

11. Tell me more about the community involvement in the use and management of *Masau* before drought/floods events in Muzarabani?

13. What is your organisation's position in terms of considering natural resources like Masau in your planning to reduce the community's suffering during drought or floods?

13. In your own opinion how important is Masau to the Muzarabani community during drought/floods?

14. What advice should be given to the Muzarabani community for them to benefit fully from *Masau*?

15. Other comments you would like to make.

Thank you.

Observations/comments:

Did the respondent appear to be telling the truth?

Are there any personal observations you made that seem to contradict what the respondent said?

What? Overall comments about respondent?

Appendix 3: Participant Information Sheet

School of Geography, Archaeology and Environmental Studies
Private Bag 3, Wits 2050, South Africa Enquiries: GEOGRAPHY: TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

INVITATION TO GET INVOLVED IN MY PhD RESEARCH PROJECT

Good day Sir/Madam,

My name is Anyway Katanha, a PhD student at the University of the Witwatersrand, Johannesburg, South Africa. I am doing some research for my degree. The research study aims, firstly, to investigate the contribution of Masau (*Ziziphus mauritiana*) to livelihoods and its role in reducing the suffering of people during droughts and floods experienced in Muzarabani. Secondly, to propose an alternative approach that reduces the suffering of people during droughts and floods in a semi-arid region of Muzarabani District. It is hoped that the information will also be developed for the benefit of the wider community, particularly academic institutions. This might take the form of articles or conference papers.

I am inviting you to participate in my study through an interview, because you are part of Muzarabani community. In addition you have the valuable contribution in the management of natural resources like Masau and experiences about drought and floods in Muzarabani.

The interview will take about 35 minutes, and you are free to use English, Shona, or the Local Dialect in your responses. Interview participants must be over the age of 18. If you give me permission, the interviews will be audio taped.

Participation in the research is entirely your choice. You will not be paid for participation. If you decide not to participate, your decision will not disadvantage you. You do not have to answer questions if you do not wish to.

You will not be identified by name either during the interview or in my report. Quotations from the interviews will be included in my final PhD research report. You will be provided with a summary of the results at the conclusion of the project.

If you wish to be interviewed, I will ask you to sign an agreement form. If you have any questions, you may contact me or my supervisor.

Thank you for your time.

Anyway Katanha

Appendix 4: Informed Consent Form

I hereby confirm that I have been informed about the project by study investigator Mr. Anyway Katanha. I understand that:

- my participation is voluntary.
- I do not have to answer specific questions I am not comfortable with.
- I can withdraw from the project at any time and do not have to provide any reason for withdrawing.
- my personal information will remain confidential to the researchers, and my name will not be used.

I have had the opportunity to have questions answered to my satisfaction.

I declare that I am over 18 years of age and I agree to be interviewed for the study.

I agree/ do not agree to the interview being audio-taped.

PARTICIPANT' S

Signature ----------Date----------

Appendix 5: Ethics Clearance Certificate

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Katanha

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H15/07/22**
PROJECT TITLE	Pro-poor adaptation to extreme weather conditions in semi-arid regions of Zimbabwe: Exploring the role of Ziziphus Mauritiana and network interventions in Muzarabani district
INVESTIGATOR(S)	Mr A Katanha
SCHOOL/DEPARTMENT	GAES/
DATE CONSIDERED	24 July 2015
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	01 February 2019

DATE 02 February 2016 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Professor T Dirsuweit

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES