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AN INVESTIGATION ON THE PRACTICABILITY OF PARAMETRIC INSURANCE IN ZIMBABWE

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DECLARATION OF ORIGINALITY

I, **Tatenda Nyamande** declare that this dissertation presented here is, to the best of my knowledge and belief, original and the result of my own investigations, except as acknowledged, and has not been submitted, either in part or whole, for a degree at this or any other University.

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DEDICATION

I would like to dedicate this research to my brother Ackim Nyamande and my sister Phailas Nyamande. I hope I made you proud and have set a good example in the family. This research is also dedicated to my parents Mr. and Mrs. Nyamande. I hope I am making you proud as well

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I would like to thank God for giving me strength to finish this dissertation and being ever present. Without his guidance, this dissertation would not have been possible.

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Abstract

This study sought to investigate the practicability of adopting parametric insurance in Zimbabwe as an alternative in financing natural disasters. The background of study emanated from uncertainty of climate changes and recurring natural disasters that affect Zimbabwe at large. The main objectives of this study were to establish a solid ground for the adoption of parametric insurance and to determine special cover arrangement that Zimbabwe can take given its history on natural disasters. The literature reviewed focused on how weather index insurance operates, merits, demerits and how low-income countries like Zimbabwe can effectively adopt it citing relevant examples. The main source of literature was the internet specifically online publications like books, journals and articles. The study population consisted of all 8 local reinsurance companies and the Insurance and Pension Commission. Self-administered questionnaires and an interview were used to collect data from the field. The data was analyzed and presented qualitatively in the form of charts, graphs and tables. The study reviewed that Zimbabwe has the required weather infrastructure and data to adopt weather index contracts especially linked to rainfall. The greatest challenge however was lack of financial capacity. Recommendations were made to insurance companies and the government which included setting up a catastrophe risk pool, use of catastrophic bonds, collateralized reinsurance and government incentives

Contents

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This study seeks to investigate the practicability of parametric insurance in Zimbabwe. It comes at a time when the world is struggling with the effects of the COVID 19 pandemic and the recent natural disasters occurring in the country such as Cyclone Idai and the Tokwe-Mukosi dam floods. It left the country exposed and the need for a remedy has to be found for the greater good of the nation.

1.2 Background of study

Many countries across the globe have been affected by natural disasters for the past decades. The increase in natural catastrophes has threatened infrastructure, people's personal belongings, human life as well as agricultural produce. According to IPCC (2007), the changes in climate across the globe has exacerbated such devastating events. No country can insulate itself from natural disasters and such hazards cannot be prevented from occurring. Billions of dollars have been spent worldwide to recover from natural disasters and despite efforts being made to recover from these disasters, they have become frequent. Developing countries have been exposed to natural disasters and Zimbabwe is one of the countries. They usually fail to shoulder the losses which come as a result of catastrophic perils since they don't have a financial base which is strong. In most times when disasters occur, the governments across the world have found it difficult to raise funds, offering disaster relief and Zimbabwe has also experienced the same. This gives rise to the need for risk management tools to finance natural disasters.

In the past years, Zimbabwe has been one of the victim countries to be severely affected by natural disasters. The impacts of natural disasters are being felt across the country threatening resilience, sustainable development and reinforcing poverty cycles. These disasters specifically alternate between floods and drought. A disaster is a process which is triggered by natural or human induced activities and due to vulnerability conditions on the population, infrastructure, causes serious alterations and prevents the normal functioning of affected communities up to the extent that they cannot cope using their own resources (Cardona, 2003). Natural disasters have often affected the agriculture sector with most people in the farming sector incurring huge losses hence threatening the food security of the nation (The Herald, 20 February 2020). In the Zimbabwe Independent of 18 March 2016, the natural hazards negatively impact companies causing them to close leading to unemployment, poor standards of living and food shortages.

The government works with different arms in situations of disasters and it has also put in place climate change mitigation programs such as the Climate Smart Agriculture. All these efforts show the dedication towards curbing the negative impacts of natural disasters. In most times whenever, a natural disaster occurs the government has been found wanting, without any means of disaster relief, the only resort is to call the international community for assistance. The government is the main source of compensation for disaster victims, it usually takes lengthy times for them to be assisted and the time it takes cannot alleviate poverty (Daily News, 19 February 2014). The delayed response of the government makes the public to take the role in helping the affected but their efforts are temporal.

In most cases when natural disasters strike the government has had challenges in financing these disasters and in the government's own capacity they have usually fail. Developing

countries like Zimbabwe have no strong financial muscle to cover or shoulder losses caused by catastrophic perils. Taking into consideration the Tokwe-Mukosi Dam floods which affected about 2230 families who were left homeless and 60,000 affected and the disaster alone required up to USD20 million to relocate the victims (Chidoori, 2017). When Tokwe-Mukosi flood disaster occurred, the government failed to raise funds for disaster relief. Chidoori (2017) ascertains that catastrophes such as the Tokwe-Mukosi floods bring communities to a pause, the costs of recovering, rebuilding and returning to normal life are very high. According to the Red Cross Society (2017) the cyclone Dineo floods destroyed houses, bridges, property, livestock and the government as the sole insurer was unable to compensate.

Most recent national Disaster was cyclone Idai which affected more than 1, 5 million people in Malawi, Mozambique and Zimbabwe and in Zimbabwe more deaths were reported and property destroyed (CBSNews, 18 March 2019). Property worth millions was destroyed, more deaths were recorded and some people went missing.

In the Business Times of 2, March 2020 it was reported that its now one year after cyclone Idai and government still counting costs. The report went on to ascertain that reconstruction of infrastructure was based on running contracts at the expense of the government since they do not have insurance. Cyclone Idai survivors remain in tents as rainy season nears (The Herald 04, November 2019). Accordingly the victims were pleading with government to build houses for them before the onset of rains. When natural catastrophes occurs it brings communities to a standstill and they need to recover fast to return life to normalcy. Of the costs caused by natural disasters 30% of them are insured and despite being insured protection gaps still accrue and 70 % of the losses are not insured. The burden goes to the

government, who pass the expense to the citizens by raising taxes and these prove to be inefficient ways to finance disasters (SwissRe, 2016).

After natural disasters, insurance does kicks in and the time needed to assess, process claims and make payouts is very long. Despite having comprehensive cover on some catastrophic perils, coverage gaps are still an obstacle. Chidoori (2017) alludes that the government maybe under capacitated to fill the coverage gaps left by traditional insurance to rebuild and recover from losses.

As indicated by SwissRe (2016) parametric insurance protection has become an important tool to have in the event of natural disasters. Most reinsures working together with World Bank have developed parametric insurance for both developing and developed countries. Governments must shield themselves from the financial impacts caused by natural disasters and strong cooperation between the private and other sectors may help countries in better financing of disasters through parametric protection (Margulescu *et al*, 2013). According to Scherer (2013) parametric insurance has now become the most prominent tool currently adopted and are mainly designed for nations who want to shield themselves from the consequences of natural disasters. Most countries having the need to be protected, they have utilized parametric insurance through pilot projects for example African Risk Capacity and The Caribbean Catastrophic Risk Facility.

1.3 Problem Statement

Disasters have had a devastating effect to the livelihoods of many communities. Property worth millions of dollars has been destroyed and many lives lost. Against this background,

the research sought to explore the practicability of parametric insurance in the Zimbabwean environment.

1.4 Research Objectives

The research achieved the following objectives:

- **a)** To explore the practicability of parametric insurance in Zimbabwe.
- **b)** To create a solid ground for the adoption of parametric insurance in Zimbabwe.
- **c)** To establish the cover arrangement that best suits Zimbabwe given its history on alternating natural disasters.
- **d)** To analyse the merits and challenges of adopting parametric insurance.
- **e)** To offer applicable recommendations.

1.5 Research Questions

The study answered the following questions;

a) Given the prevailing economic situation, can Zimbabwe adopt parametric insurance?

b) What measures can be put in place?

c) What are the merits of adopting parametric insurance and the challenges associated with its implementation?

d) What lessons can be learnt from other countries who have adopted parametric insurance?

1.6 Scope of study

The study was limited to the Zimbabwean economy and the local reinsurance industry.

The research was carried out for eleven months from July 2021 to May 2022.

1.7 The significance of the study

a) To the student

The study gave the author in depth knowledge and understanding of the area under study. The research is also done in order to complete the fellowship program of Insurance Institute of Zimbabwe.

b) To the Insurance Institute of Zimbabwe

The study document will become part of the institution's intellectual property and may be used to provide reference materials for the academia conducting studies on similar areas.

c) To the government and industry

The government will be in a better position to compensate and finance natural disaster risks when they occur. The insurance market and the participating companies will have knowledge of what is required for the implementation of parametric insurance. They will also benefit from increased capacity especially practicing companies.

1.8 Assumptions

a) All respondents will answer and provide precise and reliable information
b) A 75% response rate will be achieved so as to make the research findings and data analysis credible
c) The selected sample will be a true reflection of the whole population.

1.9 Literature review and theoretical framework

Unlike traditional insurance products, parametric insurance is expressed as insurance where cover is triggered with a parameter that is a metric or an index which is easy to determine (Moorcraft, 2018). According to Hazell (2010) denotes parametric insurance as a financial product which is correlated to a metric or index and it moves through a payout schedule which is layered or proportional payment schedule. According to Singer (2019), parametric insurance is a type of product that does not provide cover for actual losses or pure loss but it rather provides a payment once a triggering event occurs for example earthquakes of certain magnitudes. In support of this view, Horton (2018) indicates that parametric insurance which is also known as index-based insurance is novel and distinct in that indemnity to insured parties is based not on actual loss incurred but rather is based on the values of predetermined parameters that serve as proxies for losses. The provider of insurance provides cover or indemnity based on a formula pre-agreed when the index diverges from predetermined range of values and coverage is triggered.

With index insurance or parametric insurance, the results of the peril are correlated specifically to a parameter or index (Funa, 2016). More so Jha (2019) ascertains that index-based insurance makes payouts based on the value of the index and not relying on the losses on the ground. In support of this view Hess and Syroka (2005) points out that parametric insurance makes payments automatically if the set index reaches a pre-defined threshold or limit. This then show that it has a limit or threshold which is which creates range of values. An index is created to make a link on payments and actual financial losses. A disaster is signaled when the index crosses a set threshold and this will trigger insurance payouts. Parametric or index-based insurance becomes a critical and attractive option when it comes to managing climate risk or bad weather risks (Conradt, Finger and Sporri, 2015). Lucas (2015) pointed that parametric insurance gives cover against natural hazards and it bases on

objective and independent measurements for example, rainfall, earthquake magnitude, water level and wind speed. He further suggests that payouts are agreed advance for the values of selected indexes. According to Angier (2019) parametric or index-based insurance comes also as a solution to corporate clients and governments trying to shield themselves and get cover where traditional insurance fails. This type of insurance is suitable for correlated risks which are severe and have wide spread effects such as floods and droughts. Jha (2019) alludes that the index is highly correlated with risks and there can be no influence of the policyholder. He further points out that the indexes can include things like rainfall, regional yields, wind, temperature or other data. A weather index can be designed based on data gathered from the meteorological station for example temperature, wind or rainfall. Taking into consideration agriculture, this can be based on the average regional yield and correlated to rainfall.

1.10 Research Methodology

For this research, the study population comprised of eight registered reinsurance companies in the local market and the government of Zimbabwe represented by its arm IPEC. The study population is made up of eight companies. Questionnaires were used to gather the primary data.

1.11 Summary

This chapter gave an introduction of the study and laid down the background of the study and outlined the factors which prompted this research. It also gave the statement of the problem which is the major agenda of the research. Following the problem statement, research questions, study objectives, assumptions, scope of study and the significance of the study,

literature reviews were outlined. Last but not least, the methodology to be used to collect the data was stated. There was a need to come up with additional literature to support the research exercise.

CHAPTER TWO: LITERATURE REVIEW

1.0 Introduction

This Chapter Two focuses on appraising the literature, both the theories and empirical studies. Emphasis in the chapter is directed towards addressing the key concepts that of practicability of parametric insurance in Zimbabwe. The chapter presents the concepts that is parametric insurance and the base theories underpinning the study together with empirical framework that will presented as per objectives. The chapter will also present the empirical evidence that is case studies were parametric insurance have been applied and also provide a conceptual framework figure, the chapter ends with a chapter summary.

1.1 Conceptual framework

1.1.1. Key Concepts; Parametric Insurance

Although parametric insurance products appear to be a new phenomenon, they have existed in the past. According to Scherer (2013), these goods first appeared in the 1990s and were largely employed as pilot projects. Parametric insurance is now making its way into the corporate insurance market, according to Brettler and Gosnear (2020), but it has been available in general since the late 1990s. India was the first country to present an honorable

notion when it proposed index insurance for rainfall, which was based on a book written by Chakravati in 1920. (Mahul and Stutley, 2010).

The proposal was never implemented, but because India was the first developing country to make one, credit should be given and it is important to note where the concept came from. According to Carter et al (2014), India implemented its first weather index in 2003, with the program primarily benefiting smallholder farmers producing a variety of crops. He also claims that in 2007, the same country implemented parametric or index-based insurance for farmers cultivating potatoes under Pepsico's contract, the index being temperature and humidity. The sole purpose of parametric insurance was to provide disaster aid to countries in the aftermath of natural disasters such as tropical cyclones, droughts, and earthquakes. In the year 2003 Malawi was helped by the World Bank which worked together with global reinsurers.

A drought-prevention plan was devised, with compensation provided whenever seasonal rainfall levels collected at meteorological stations fell below a predetermined level. According to Scherer (2013), despite the fact that pilot programs have primarily been conducted since the 1990s, Mexico became the first state to join into an insurance contract in 2006. He also claimed that a regional macro index insurance program was created for the first time in 2007. The Caribbean Catastrophe Risk Insurance Facility was the first multi-nation parametric insurance facility, established to provide coverage for Caribbean governments.

A parametric insurance product can be defined as an insurance contract where the ultimate payment or contract settlement is determined by a weather or geological observation or index, such as average temperature or rainfall over a given period or the intensity of an earthquake

or wind storm (Holton, 2018; Singer, 2019). Parametric insurance payouts are not based on individual loss adjustments, but are determined according to the measurement of a highly correlated index. Therefore, there is the potential for a mismatch between parametric insurance claims settlement and the actual losses of the insured, which is generally referred to as basis risk.

More specifically, Jha (2019) establishes that index-based insurance pays out based on the value of the index rather than on actual losses. Parametric insurance, according to Hesi and Syroka (2005), pays payments automatically if the set index surpasses a pre-defined threshold or limit. This indicates that it has a limit or threshold, resulting in a range of values. To establish a link between payouts and actual financial losses, an index is constructed. When the index reaches a certain level, it is considered a disaster, and insurance payouts are triggered.

Weather Index Insurance Recent developments in using parametric insurance provide good opportunities for promoting disaster insurance in Asia and the Pacific (Singer, 2019). Parametric insurance refers to insurance that responds to objective parameters (such as rainfall or temperature) at defined measurement institutions over an agreed period of time. All policy holders of the same contract within the defined area will receive the same amount of payment if the index exceeds certain levels of pre-determined threshold (Franco et al., 2019; Sandland, Schilling & Marke, 2019). Accordingly, parametric insurance, and weather index insurance (WII) in particular, can be best adopted when there are strong correlations between the weather index and damage and losses

1.1.2 Parametric Insurance and Natural Disasters

The losses that comes as a result of disasters are beyond the ability and coping capacity of a community (International Federation of Red Cross, 2015). In support of this view, Jha et al (200) ascertains that a disaster exist when there are severe alterations to the normal functioning of a society as a result of physical events which are hazardous, interacts with vulnerable social conditions. It is a hazardous disturbance to a given society causing widespread human and material losses (UNISDR, 2009).

Natural disasters are natural occurrences that are driven by catastrophic risks, which might be hydrological, geological, or climatological (International Federation of Red Cross and Red Crescent Societies, no date). Hazards are another term for the aforementioned terrible perils. Natural hazard, according to ISDR (2004) in Stewart and Donovan (2008), is a process or phenomena that normally occurs in the biosphere and results in a dangerous event. Bryant, Head, and Morrison (2005) support this viewpoint by stating that it is a harmful event that can injure humans, but it occurs beyond of human control. They go on to say that natural risks can turn into natural catastrophes if their consequences are severe. They further allude that natural hazards can escalate to natural disasters if their effects are in huge amounts far exceeding the coping and recovering capacity.

2.2 Theoretical framework

2.2.1 Technology Acceptance Model

It is worth noting that the use of technology is largely influenced by multidimensional forces such as economic, social and regulatory (Bush, 2006; Garcia, Perez-Lugo, & Baiges, 2008; Leucht, Kölbel, Laborgne, & Khomenko, 2010). Technology acceptance remained one of the important fields of study over the last two decades (Chuttur, 2009).

TAM is a pioneering theory that has been employed by various studies in the literature. Davis (1989) developed the TAM to identify the factors that cause technology and system failures. The theory proposed that two factors i.e. perceived ease of use (PEOU) and perceived usefulness (PU) to explain the motivation of users. The aforementioned two factors are considered important that influence Attitudes (ATT) of users and eventually, Behavioral intention (BI) that determine the actual system use. The Technology Acceptance Model is an adjusted expectancy value theory, which states that consumers behave according to their beliefs about the outcome of their behaviour and the value attached to those outcomes (Jackson, 2005). This model has been used widely in the area of technology acceptance: over 580 articles have been published over the last 35 years (Chang et al., 2010). For instance, the Technology Acceptance Model has been shown to successfully predict the acceptance of information technology (IT) such as online shopping (Henderson & Divett, 2003), online banking (Ndubisi, 2007), and health information technology (Holden & Karsh, 2010).

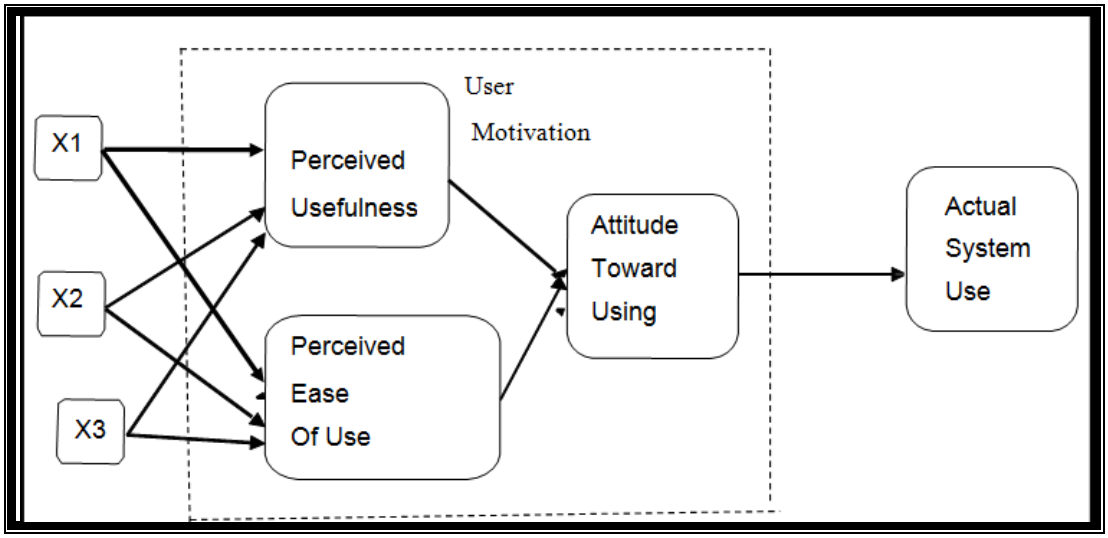
Technology Acceptance Model (TAM) is basically an individual's acceptance of certain information technology and information system (Davis, 1989). The two most important factors of TAM model are: perceived usefulness—that shows the importance and subjective capabilities of individuals to use computer base applications in a way to derive maximum utility of his/her work to perform in an efficient manner (Sharma & Kar, 2015; ; Dwivedi et al., 2019; Schmidthuber et al., 2020). The perceived ease of use—it is related to how an individual feel easiness and capable to use computer base applications with quite low efforts. It was quite obvious that both the factors influenced by the number of external factors through which the end-use of the actual system could be halted for a while. The previous studies largely presented the numerous external factors that affect the use of the actual system, including social factors, cultural factors, and political factors (Davis, 1989; Ajzen,

1991; Taylor and Todd, 1995; Surendran, 2012; Dwivedi et al., 2019; Schmidthuber et al., 2020, etc.). TAM aims at proffering an explanation of the antecedents of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified (Davis et al., 1989: 985). Venkatesh, (2000) concludes that TAM's two specific viewpoints, perceived ease of use and perceived usefulness, establish one's behavioural intention to use a technology.

- Perceived ease of use (PEOU) can be explained as the extent to which a person believes that using a technology will be free of effort. Venkatesh (2000) asserts that it is a construct is tied to an individual's assessment of the effort involved in the process of using the system. Perceived usefulness is defined as the degree to which the use of the technology in question is believed to enhance the achievement of valued goals (job performance in Davis's original study) (Dwivedi et al., 2019; Schmidthuber et al., 2020), and perceived ease-of-use is defined as the degree to which use of the technology in question is believed to be easy and effortless. These beliefs are in principal determined by external variables, such as knowledge, experience, demographics, personal characteristics etc. Perceived usefulness and perceived ease of use are assumed to determine a person's attitude toward using the technology. If using a new technology is evaluated favourably (i.e., the person's attitude towards doing so is positive), the person is expected to form an intention to use it (when made available to him or her) (Skoulou, 2011; Dwivedi et al., 2019). When an intention to use a new technology is expressed in response to a request to use it, this intention is often referred to as technology acceptance (Huijts et al., 2012). Perceived usefulness has also been found to directly influence acceptance of the technology. If the

consumer accepts the technology, the model assumes that this will lead to actual use (i.e., usage behaviour) (Sarakiya, 2015).

- Perceived usefulness (PU) is expressed by Sun and Zhang (2006) as "the degree to which a person believes that using a particular technology will enhance his [or her] performance).Further, Venkatesh (2000) posits that perceived usefulness will be influenced by perceived ease of use in TAM.



Technology Acceptance Model is that it was developed for the particular field of technology acceptance, and in several studies it has been found to explain more variance than both Theory of Reason Action (Davis et al., 1989) and the Theory of Planned Behavior (Chau & Hu, 2001, 2002; Mathieson, 1991) when compared. Thus, the need for disaster reduction always plays a pivotal role in economic activity that would be helpful to achieve. The role of parametric insurance in technology-oriented growth is imperative disaster reduction. The model argued that parametric insurance is deemed desirable in order to proceed toward

towards a better environment. According to TAM, individuals will only adopt an parametric insurance if they perceive that the system is beneficial to them and that the system will improve their job performance, the so-called perceived usefulness (PU). This was also summarized by Davis et al. (1989) stating that "Computer systems cannot improve performance if they aren't used. Unfortunately, resistance to end-user systems by managers and professionals is a widespread problem." Furthermore, the adoption of the parametric insurance technology is also affected by the perceived ease of use (PEOU), which captures the person's perceptions of how easy it is to use the system and how difficult it is to learn the system, the efforts that are required to use the system (Gounaris and Kortitos, 2008).

Innovation Diffusion Theory (DTI) (Rogers, 1983 & 2003)

Information and communication technology (ICT) and information systems (IS) research has been extensively applied Innovation Diffusion Theory (DIT) (Tung, Chang & Chou, 2008). According to the DIT certain characteristics of an innovation, as perceived by individuals, explain the rate of adoption. These characteristics are the following (Rogers, 2003, p. 15-16):

- **Relative advantage.** This is the degree to which an innovation is perceived as being superior to the idea it succeeds. Rogers (2003) contends that the perceived advantage is more persuasive in the adoption stage than the objective advantage.
- **Compatibility**. This is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters.
- **Complexity.** The degree to which an innovation is perceived as being difficult to understand and/or to use.

- **Trialability.** The degree to which an innovation may be experimented with on a limited basis. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.
- **Observability.** This is the degree to which the results of an innovation are visible to others.

Further to the characteristics of an innovation proposed by Rogers (2003) that influence its diffusion, Moore and Benbasat (1991) identified two additional characteristics. These two characteristics are:

- **Image.** The degree to which an innovation is perceived to improve the user's image or status in a given social system.
- **Voluntariness of use**. The degree that an innovation is perceived as being voluntary or an act of free will.

Rogers (2003) contends that innovations offering more relative advantage, compatibility, simplicity, trialability, and observability will be adopted faster than other innovations. Accordingly it can be expected that innovations that are seen by individuals as being superior to its forerunner(s), compatible with past experiences, needs and values of the user, easy to use, easy to trail use and to observe, offers an image advantage and the adoption is an act of free will, will be adopted more quickly than other innovations. As such, it can be argued that the presence of all of these variables speeds up the innovation-diffusion process while the absence of one or more slows down the process.

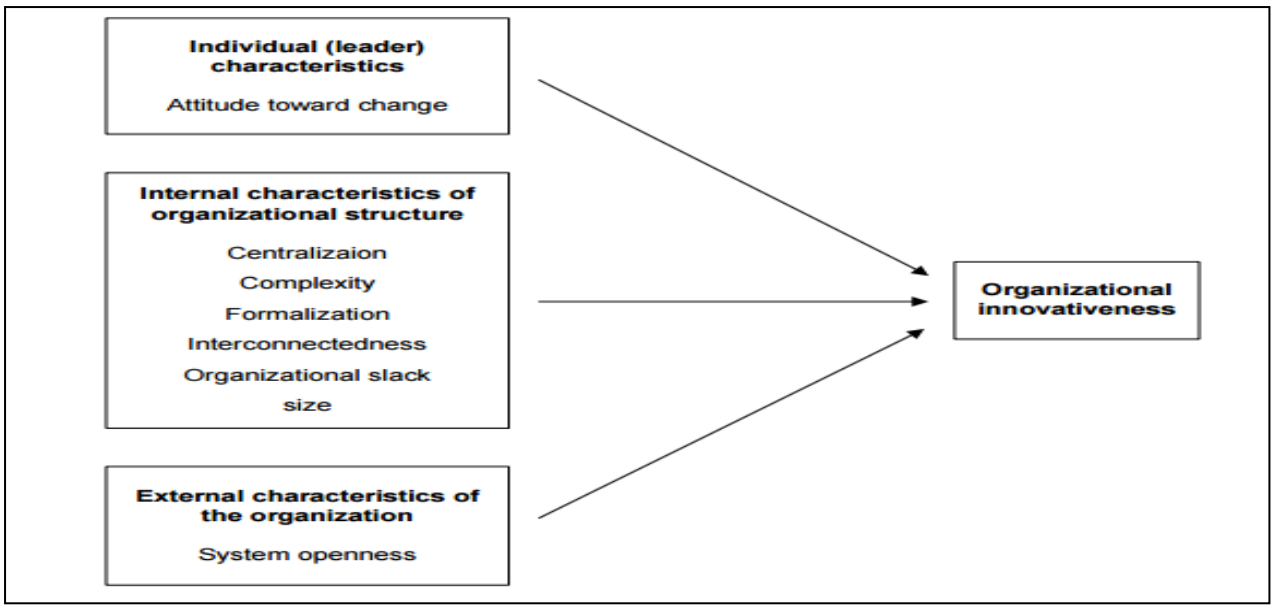


Figure 2.8: The diffusion of innovations model

Source: Rogers (2003)

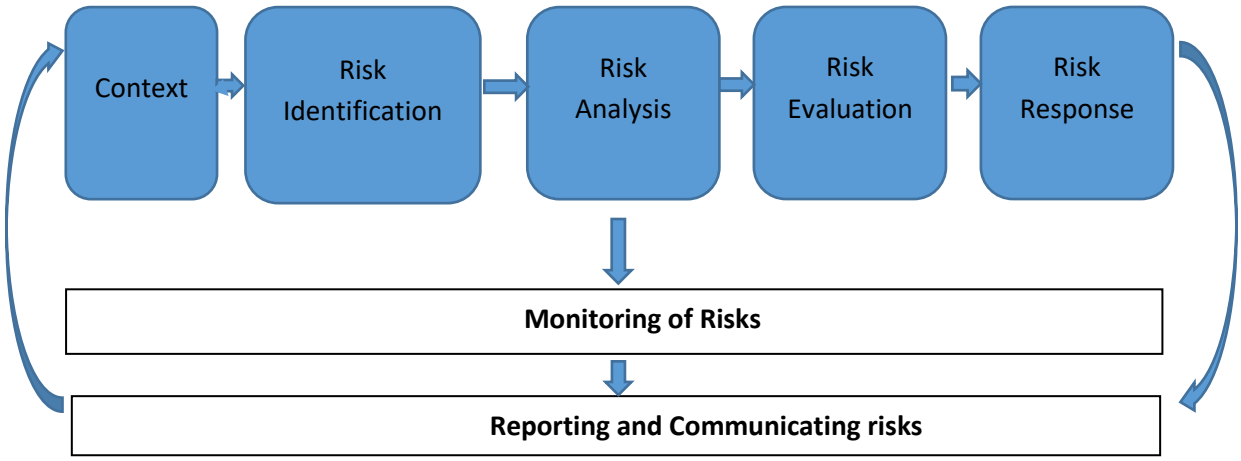
The current study argues that the linkage between DTI factors and TOE adoption antecedent factors can be applied as predictors to ICT resources use. The added emphasis on managerial characteristics of the senior management derived from DTI as a distinctive internal organisational factor is consistent with TOE organisational factors variable of top management.

2.2.2 The risk management process

According to Manatsa (2009) risk management involves the application of systematic management policies and procedures to the tasks of identifying, analyzing, assessment, treating and monitoring risk. As indicated by the Institute of Risk Management (2002) it is a

methodological process which allows organizations to address risks which are attached to their day to day activities. The focus of good risk management is on identification and treatment given to those perils. Risk management process involves the establishment of context, identification of risks, analyzing, and evaluation, responding to risks, monitoring and reporting risks (Doherty, 2000).

Figure 2.1 The risk management stages



Source: **National Research Council (2001)**

- **Establishing Context**

When establishing the context in risk management involves a clear understanding of the vision, mission, objectives, external environment and the internal environment, thus according to the (National Research Council, 2001). This paves way or sets the foundation of

risk identification. The context at country level involves studying the weather environment from across provinces up to sub district level.

- **Risk identification**

As indicated by Harrington and Niehaus (2003) at this stage a potential risks or opportunities are listed down. A defined context will guide the process of identifying risks (IRM, 2002). As indicated by Manatsa (2009) this stage or step identifies which hazard or events might translate into disasters and areas of risk as well as sources of risk are identified. The techniques used to identify risks are flow charts, checklists, observations only to mention a few. At country level it involves listing of all possible natural hazards for example floods, hurricanes and droughts.

- **Risk analysis**

Doherty (2000) cites that risk analysis entails the assessment of identified risks in relation to the likelihood of their occurrence and the severity. Quantitative and qualitative data are used in making the assessment. It entails identifying the extent, nature of risk as well as determining the degree and existence of risk (Guzman, 2003).

- **Risk evaluation**

Raz and Hillson (2005) ascertains that on this stage decisions on whether to accept risks or give specific treatment for each risks are made. In addition the prioritization of risks is made on this stage. As a country we can be exposed to many natural disasters and with risk evaluation this would enable the country to select which risks require special and immediate attention.

- **Risk responding**

At this stage of the process the moment of action begins. As indicated by the IRM (2002), this stage entails the treatment of risks and it involves coming up with actions and strategies to deal with risks. The main objective of this stage is to bring out cost effective strategies of treating risks (Berg, 2010). Stoneburner, Goguen and Feriga, (2002) indicate that the options in treating risk include risk avoiding, reduction, eliminating, accepting and transferring. Parametric insurance falls under risk transfer or risk financing in this context.

- **Risk monitoring**

According to Harrington and Niehas (2003) monitoring of risks takes into account the measuring the results of risk treatment. In addition Raz and Hillson (2005) cites that this stage requires a continuous checking of the statuses of risks and checking for any changes on the expected performance levels of risks. This can give the room to make changes and make new strategies for example if there is a parametric policy covering natural disasters, with risk monitoring it would include taking a look into the premiums paid and knocking them against claims **paid or registered and any mismatch will trigger renewal or cancellation of the policy.**

- **Risk reporting and communicating**

This is when significant stakeholders are educated about the status of risks and how they are handled, according to Stoneburner, Goguen, and Feringa (2002). According to Jha et al (2013), good risk communication is critical because it allows stakeholders in government, civil society, and the corporate sector to make better risk management decisions. The general public, funders, ministries, and partners may all be included in a country's population.

2.3 Empirical framework

2.3.1 The practicability of parametric insurance

Since 1999, the development community has been looking into the potential applications of weather derivatives markets for poor countries, while much of the work was done at a research level until 2003. (Singer, 2019). However, the number of countries in the implementation phase of pilot parametric insurance programs has rapidly increased since then. According to available information, more than 30 pilot programs are now underway in roughly 20 countries.

Few countries have more than one or two years of operational experience, according to the commercial reality. Ethiopia and Malawi are two cases worth considering in the context of the African continent (Franco et al., 2019). The initiatives completed in these two nations deserve special attention because they represent two extremes of the wide range of weather index insurance products that can be used in Africa. The World Food Programme purchased a risk transfer product in Ethiopia to bolster humanitarian relief. Smallholder farmers in Malawi purchased a risk transfer product as part of a loan for an input package that encouraged the adoption of new technology (Cohn, 2016). Projects in Ethiopia and Malawi have been extremely successful in terms of raising public awareness by Projects in Ethiopia and Malawi have been extremely successful in terms of raising public awareness by:

- Demonstrating that a market-based risk management approach for natural disasters is practicable in developing and low-income nations.
- Providing proof of weather shocks' multi-dimensional impact and the viability of utilizing risk transfer products to manage exposure at all levels of society, from small farmers to sovereign governments and the international community.

Nonetheless, it is important noting that, with the exception of India and Mexico, the majority of initiatives in operation in developing and emerging countries (with the exception of India and Mexico) have either been piloted or are in the early phases of expansion within a regulated setting. As a result, initiatives that meet any of the following criteria are frequently given priority (Carrera, 2018):

Better quality data

- A limited risk exposure reducing the need for risk capital from international markets,
- The ability to overcome local institutional weaknesses by reducing the scope of the project.

The final beneficiaries of many contemporary parametric index insurance tests have been households engaged in agricultural production. Although some novel delivery mechanisms have been proposed, it is still necessary to test alternatives such as composite products (which link insurance to credit or goods and services in the agricultural value chain) as hedging tools for financial intermediaries in both the formal and informal sectors, or even as a risk transfer alternative for agricultural value chain firms whose revenues are affected by weather (Broberg, 2020).

Weather index insurance can also be purchased by governments and donors to support natural disaster relief efforts or to safeguard the vulnerability of public infrastructure or low-income population assets that are difficult to insure using regular products (Van and Nevius, 2011). Mexico serves as an interesting reference model, with the government implementing a risk transfer program that combines emergency aid, government infrastructure, and low-income population assets. While the pilot approach shown that these instruments are possible, the

international community has recognized that achieving meaningful scaling in these markets has many hurdles.

To make parametric insurance products function, developing countries may need to increase the efficiency and dependability of their weather infrastructure, while satellite-based weather measurement can supplement (or replace) weather station data (Kusuma & Nguyen, 2019). When properly understood, satellite data is not only important for addressing information gaps, but it also has the added benefit of being relatively temper-proof. Although there are still problems with satellite data, such as poor performance in steep terrain, progress is rapid, and this is a promising subject.

Local stakeholders' ability and knowledge must be built in order to effectively exploit the benefits of parametric insurance. There is also a dearth of understanding in India about how insurance can aid smallholder farmers and how index insurance can transfer disaster risk (Gine, Townsend and Vickery, 2018). On a more institutional level, it's critical to ensure that the public sector is willing to work with the private sector to support parametric insurance products. It has been suggested that parametric insurance is most effective in a market economy (IFAD, 2012). However it requires significant weather infrastructure and institutional pre-conditions that may be difficult to achieve without public sector support. Private-public partnerships thus hold one of the keys to initiating successful parametric insurance schemes.

In China, the Chinese government, local insurance businesses, and international organizations collaborated on a 2018 trial parametric insurance program in Anhui province. While parametric insurance, particularly WII, provides significant opportunity for insurers, it also

comes with a certain element of risk (Singer, 2019; Broberg, 2020). As a result, small and medium-sized local insurers, in particular, would need to work with reinsurance companies to transfer disaster risk further offshore. In the region, the reinsurance sector's involvement in disaster insurance has been minimal. To increase parametric insurance, big reinsurers must be attracted by expanding insurance markets and providing financial incentives as well as regulatory support (Lin & Known, 2020).

2.3.2 The solid ground of the adoption of parametric insurance

Weather insurance is always changing on a global scale. While the concept of a weather-based index has been widely adopted, a number of pilot projects using a mix of satellite technology and weather index are currently underway across Asia and the Pacific. China, India, and Thailand are all in different stages of implementing WII, with varying levels of official assistance (Lin & Kwon, 2020; Singer, 2019; Kusuma et al., 2019). Their experiences suggest that in order to develop WII as a long-term DRR instrument, many aspects of insurance design and distribution must be improved.

The following critical issues must be addressed in particular (Sirimanne and others, 2015). The successful development of parametric insurance requires investments in technological breakthroughs. Some examples include the expansion of hydro-meteorological networks in drought-prone areas, the creation of crop-specific disaster loss records, and satellite-based insurance products. As Van et al. (2011) point out, improving target customer awareness is particularly important because potential insurance buyers are often misinformed about insurance products and do not completely comprehend the benefits. Introduction of parametric insurance should thus be accompanied by proper marketing and awareness raising campaigns.

Furthermore, in order to develop parametric insurance, it is vital to minimize base risk. Increasing the index's correlation with real damage and losses will not only result in a better product, but it will also boost insurer confidence. Parametric insurance can benefit from risk-layered schemes (Johnoson, 2021). Multiple insurers take on different layers of risk coverage for a single WII contract in a risk-layer based approach. It is also necessary to create reinsurance markets in order to attract private insurance companies to participate and successfully shift risk from local to international insurance markets. This is especially critical for the poor and vulnerable, who are typically deemed too hazardous to insure by insurance companies. Targeting institutional level insurance consumers can help the parametric insurance industry expand its reach. Institutions such as cooperatives, banks with outstanding loans, and international organizations committed to assisting in times of crisis are all encouraged to get parametric insurance to protect their portfolios (Cohn et al., 2016; Kusuma et al., 2019).

In order to make parametric insurance a success, it is critical to have an adequate infrastructure that allows for the acquisition or retrieval of high-quality data (Hazell et al, 2010). There is a critical need for adequate data, and it is critical that weather stations be protected so that unbiased weather data can be provided. According to Skees, Murphy, and Collier (2007), the effectiveness of parametric insurance creation is based on the following data requirements:

a) The weather data must be more than 30 years for extreme risks
b) Missing weather data must be below one percent.
c) A weather station which is secure must be available.

d) Honesty in handling data and recording.
e) Changes of instruments must be limited.
f) Reliable settlement mechanisms.
g) Level of tampering risk must be low.

Coming up with the above data requirements in industrialized countries is not difficult due to developments, even when it comes to their weather stations, which are more advanced. However, less developed countries, particularly those in Africa, face difficulty in obtaining meteorological data since local weather stations do not fulfill international criteria (Cummnis, 2006). Despite the fact that the devices used to collect weather data around the world are similar and the techniques are similar, any country can produce index-based insurance for weather-related risks.

According to Sirimanne et al. (2015), reinsurers must be involved for parametric insurance to be successful, and this will allow the transfer of catastrophic risk to some overseas markets via retroceding. Through government incentives and regulatory support, the government must assume responsibility for attracting reinsurers to provide parametric insurance. According to Sirimanne et al. (2015), the government is required to engage reinsurance companies to provide parametric insurance coverage using financial incentives and regulatory support. This helps to adopt parametric insurance since reinsurance companies are given the motive to underwrite disaster risk More importantly, the participation or involvement of reinsurance companies will encourage insurers to participate, resulting in a win-win situation for the government. Government assistance and incentives The insurance business in most underdeveloped nations lacks the capacity to underwrite disaster risk, which parametric

insurance covers. The government should provide financial and regulatory incentives for reinsurers to engage in the implementation of parametric insurance.

Carrera (2018) found that the usage of disaster bonds to increase capacity is required. Insurance carriers employed them, according to Kampa (2010), to gain extra protection for high-severity low-probability occurrences. Catastrophic bonds allow reinsurers the ability to underwrite catastrophic risks since they provide crowd reinsurance coverage. Parametric Catastrophe bonds, for example, are linked to physical event factors like wind speed. The bond will not pay if the long requirements are not met. Reinsurers should employ parametric catastrophic bonds to strengthen their capacity to underwrite catastrophic risks.

The World Bank (2017) proposes that a clearing house is responsible for gathering data on climate and weather. The information is gathered in order to lower the cost of risk assessments and index tracking. There is also an unified resource for information on parametric insurance designs and best practices. The Green Climate Fund, which is handled by an international financial organization, is an example of a clearing house. International organizations and developing countries should be involved (OECD, 2019). Developing countries should seek support from G7 countries and international organizations in order to meet the success factors of parametric insurance. China and Japan, for example, are supporting emerging countries in establishing parametric insurance products. The developing countries with the least capacity to respond to climate change's effects are the most vulnerable (World Bank, 2017).

International support from Group 7 countries, multilateral development institutions, and the private sector is critical for parametric insurance to succeed. Their assistance is critical in making climate-related risk insurance more accessible. The nation's ability to access the insurance market will improve, and critical economic and environmental data will be gathered. Furthermore, to cut costs in the first phase, which may hinder private insurers from entering new insurance markets due to insufficient experience and limited liquidity. The World Bank, for example, aided Malawi in establishing index-based insurance (Dorbor, 2020).

Insurance companies and reinsurance companies should collaborate. Reinsurance and insurance companies should be allowed to collaborate in order to underwrite disaster risk. According to GFDRR (2014), when weather index-based insurance was introduced in Malawi, nine insurance companies collaborated to underwrite the program's risk. This was done to boost underwriting capacity.

A solid ground of parametric insurance requires the following (Figueiredo et al., 2018):

- Weather infrastructure development. For example, the development of a weather station with advanced equipment to obtain quality weather data.
- Sufficient financial capacity Assistance from developed countries is needed for parametric insurance to be successful
- Government support to the insurance industry by providing financial incentives to increase reinsurance potential to underwrite catastrophe risk.
- Flexible legislation that allows more players to be willing to join parametric insurance is very essential.

- Moreover, education about parametric insurance by the providers is very important for easy implementation.

2.3.3. Cover arrangement of parametric insurance on alternating natural disasters

2.3.3.1 How Parametric Insurance works

According to Turvey (2001), index insurance plans define an event and establish a link to the payment threshold, which is accomplished by a payment schedule. The advantages of parametric insurance will be determined by a predetermined payment table that will reflect the severity of the incidents (Foucart, 2018). According to Baison (2018), parametric insurance products work in three stages: pre-inception, on-risk, and post-loss.Pre inception stage- on this stage the main things which are considered are hazard intensity, premiums and potential payout

a) On risk stage- on this stage what will be required is the constant monitoring of the index.
b) Post loss- this stage is when the automatic claims payment are made.

The indemnity schedules and the probability of an index that could trigger payments affect premium rates. Payments will commence when the threshold is exceeded, according to Barnett, Barret, and Skees (2008), and will climb as the index value approaches a limit. When it comes to possible payments or payouts, parametric insurance or index-based insurance products have a fixed payment rate for all policyholders on the contract, regardless of the actual financial losses experienced. The amount of the payment is determined by the amount insured or the coverage selected.

Skees, Barnett and Hartell (2005) cited a hypothetical example of an index contract with the below summary:

On this contract the index is on rainfall and the payout is triggered by the below average rainfall recorded. Sum insured is Z$60,000 (maximum payout), payment threshold is 120mm of rainfall and a lower limit of 60mm. When the rainfall collected is below 120mm, the payments are triggered and settled for every mm of rainfall up to the limit of 60mm. When the amount of rainfall collected is above 120mm no payout will be made.

Parametric insurance policy details

Insured:	Zimbabwean Government
Weather Station:	Belvedere Urban Station
Covered Peril:	Drought
Index variable:	Rainfall
Threshold:	120mm of rainfall
Limit:	60mm of rainfall
Sum insured:	Z$600, 000,000

Payout rate; the difference between the value of the threshold and the index value, divided by threshold value minus the limit:

= [threshold-actual value] / [threshold-limit]

= [120-X] / [120-60]

Where X is the actual value

Policy payout; when coming up with the payout the above payment rate is multiplied cover purchased

= [120-X] / [120-60] x 600, 000, 000

Assuming that at the end of the seasonal rainfall period, the rainfall received was 80mm and this the value of the indemnity payment will be as follows

= [120-80] / [120-60] x 600, 000, 000

= [40] / [60] x 600,000,000

= 2/3 x 600,000,000

Potential payout = Z $ 400, 000,000

From the above example it is depicted that the payout will be Z$ 400, 000,000

2.3.3.2 Parametric insurance key elements

Parametric insurance contracts, according to Brettler and Gosnear (2020) and Angier (2019), are constructed around two key elements: payout mechanisms and triggering events. They go on to say that the two aspects clearly define the policy's scope and pricing, as well as other terms that determine how much the insured would be reimbursed. To begin, only if a triggering event hits a defined trigger for an index indicating the hazard in question will the insurance make payments. More importantly, the index must reflect the client's risk.

Hurricanes, floods, and earthquakes are common triggering events, with wind speed, quake magnitude, and precipitation level serving as the index (Brettler and Gosnear, 2020).Finally, there is a payment system, which determines what happens when an event meets or surpasses a predetermined threshold. Payment mechanisms, according to Brettler and Gosnear (2020), establish how much should be paid to the insurer. For example, a pre-agreed payout parameter is 100% on the limit of a quake magnitude of 7.0 or above. If an earthquake strikes with a magnitude of 7.1, the insured will get a 100 percent reimbursement.

Hazell et al alludes that the payment mechanism of index insurance is categorized as below:

a) Zero Contract- the payment on the policy is 100% if the predefined threshold is surpassed.
b) Proportional payment – fixed payouts for every threshold or trigger
c) Layered structure- on this payment mechanism, fixed payments will be made in different percentages once the threshold is surpassed.

2.3.3.3 **The supply chain of the index**

The supply chain, according to Greatrex et al. (2015), refers to the participants in the parametric insurance program or scheme, as well as their functions, which are primarily impacted by the delivery model. Despite the differences between index and traditional insurance, the index supply chain is nearly identical. The policyholder or insured, the insurer, and finally the reinsurers are the participants (brokers and agents ignored). Policyholders are still the ones who buy insurance, and they are the ones who are buying the parametric insurance program in this scenario. Buyers of the index scheme are classified into three levels, according to Schaefer and Waters (2015) and Miranda and Farrin (2012):

- **Micro level - a**t this level, insurance is provided directly to individuals who are policyholders. Market vendors, a single farmer, or farmers are all examples (cooperatives).
- **Meso level -** this level includes policyholders who are known as risk aggregators, such as associations, mutuals, and NGOs, who receive money from the provider and subsequently provide services to policyholders. For example, consider an agricultural bank that provides loans to farmers and manages its risk through parametric weather insurance**.**
- **Macro level** – Governments, states, and state agencies are in charge of policies at this level. Insurance for natural disasters or catastrophic occurrences may be purchased by the government (parametric insurance). These occurrences may put a strain on the budget and create liquidity shortages, but by purchasing parametric insurance, payouts may be more helpful in post-disaster financing.

The principal takers or bearers of risk are insurance (Hellmuth et al. 2009). Commercial or government-owned insurance companies can be insurers. In most situations, insurers are in charge of product design, development, and back-office administration. In the case of index insurance, the back office is responsible for tasks such as index monitoring and payouts.

Finally, there are reinsurers who operate as secondary risk bearers in the supply chain. For linked risks, such as those arising from natural catastrophes, local insurance companies must be able to diversify their portfolios adequately or transfer risk to a facility that can diversify, such as other global reinsurers. Climate or weather-related risks are difficult to keep, and in this scenario, self-insurance and reinsures may be the best option.

2.3.4 The merits and challenges of adopting parametric insurance

2.3.4.1 The Merits of adopting Parametric insurance

Although the development and application of WII is still in its early stages, there are a number of theoretical advantages of the product. The degree to which these theoretical advantages may be realized through implementation and further development of the product remains to be seen. Index insurance has gained increasing importance as a way of coping with the adverse effects of natural disasters

- Reduced risk of adverse selection.

Farmers are more likely to buy insurance if they have a greater risk, which can lead to adverse selection in agricultural insurance. An knowledge asymmetry underpins this, putting the insurer at risk (one that they need to manage through detailed, individual risk appraisal prior to premium pricing). Farmers subscribe to index insurance based on the terms, conditions, and payout scale for all farmers in their defined area, virtually resolving the insurers' adverse selection problem. According to Hazell et al. (2010), index-based insurance mitigates the problem of adverse selection. Because policyholders with the same contract pay the same premiums and receive the same indemnity, regardless of their conduct. To avoid adverse selection, customers with parametric insurance receive the same coverage based on standard terms and conditions (Clarke, 2011). According to Horton (2018), parametric insurance shifts payouts away from individual losses about which insurers have little information and toward objective index values that are publicly known and linked to specified disbursements. Adverse selection issues are decreased and eliminated.

- **Reduced moral hazard.**

Farmers may be able to affect the claim (by worsening physical losses) through their behavior under traditional insurance, a phenomenon known as moral hazard. Farmers have no power or motive to impact claims with index insurance because payouts are based on an independent and exogenous weather characteristic that is unaffected by farmer conduct. Traditional insurance, according to Horton (2018), is particularly prone to the moral hazard problem because of its architecture. Cummins and Mahul (2009) argued that moral hazard risk is typically significant in traditional insurance, and that the insured's behavior increases losses, resulting in large claims.
On the other hand, the insured may be negligent in taking all necessary precautions to prevent or mitigate risk, resulting in a loss. Farmers, for example, may be unaware or hesitant to use fertilizer despite knowing that it affects crop yields because they are covered by insurance.

- **Field loss assessment is no longer required.**

Because of the necessity to mobilize large numbers of qualified or semiskilled assessors with some agronomic understanding, loss assessment is a barrier for any traditional crop insurance operation. By eliminating the need for assessors, index insurance's ability to issue payments without field evaluation clearly cuts administrative expenses (Sandland, Schilling & Marke, 2019).

- **Low Traction Costs and Quick pay-outs**

When all other factors are equal, index or parametric insurance has low administration and traction costs. When compared to traditional insurance, Horton (2018) and Skees, Murphy, and Collier (2007) pointed out that index insurance does not require loss assessments or onsite inspections, which are both costly and time consuming. The administration expenses of metric insurance are clearly lower, and there are no conflicts between loss investigators and

insureds, resulting in a faster reimbursement. According to Moorcraft (2018), there is no requirement for loss adjustment with index insurance because as long as the trigger is set, payouts should occur. Parametric insurance's early pay-outs assist the government in providing disaster relief as quickly as possible before the harm worsens.

- **Covers protection gaps**

According to SwissRe (2016), protection gaps remain a barrier, as many damages are invariably covered by standard insurance and are not compensated. Most governments do not have sufficient funds to fill in the protection gaps. When natural disasters strike, metric or index insurance has the advantage of filling in or covering the gaps left by traditional insurance.

- Less bureaucracy and information requirements.

Traditional insurance products necessitate a significant amount of effort to collect data, calculate yields, and classify farmers based on their particular risk exposures. It is not essential to collect such precise data or to differentiate between specific farms because of the index. This is especially beneficial in nations where detailed data is difficult to get by.

- **Lower dispute risk**

Information needs and bureaucracy are reduced. According to Bouye, Bourre, and Lee (2019), parametric insurance allows for a transparent and thorough claim process. They further claimed that the procedure minimizes the likelihood of disputes between insurers and clients. This viewpoint is shared by ESCAP (2015), who claims that parametric insurance is more transparent, allowing for the avoidance of payout conflicts, which typically stymie the growth of the insurance market. Policyholders have access to information about how payouts

are made and when they are made (ESCAP, 2015). As a result, parametric insurance will provide good chances in circumstances where clients have limited faith in insurance.

- **Addresses correlated climate related or weather risks**

Another significant benefit of index insurance is that it may be used to cover natural calamities. According to Cummins and Mahul (2009), it protects or shelters agriculturally-dependent populations, regions that are most exposed to climate-related threats, and compensation for lost revenue as a result of disruption.

- **Reinsurance facilitation.**

When the insurance is based on independently measured weather events, foreign reinsurers are likely to minimize the part of the premium imposed for uncertainty ("loading").

- **Transparency**

Due to the somewhat subjective character of the loss adjustment process, the evaluation process for traditional products frequently leads to disagreements between farmers and assessors. Weather index contracts are based on the measurement of weather at specific weather stations, making them exceedingly objective and potentially less prone to result in disputes (however basis risk becomes the primary source of disagreements) (Sandland, Schilling & Marke, 2019).

- Facilitating access to financial services.

Successful index insurance markets have the ability to allow other financial instruments that are vital for poverty reduction and economic growth by removing the most catastrophic, geographically linked risk from vulnerable regions (Sandland, Schilling & Marke, 2019).

2.3.4.2 Challenges of Parametric Insurance

Even though parametric insurance is an effective disaster relief tool, it does come with some drawbacks. Parametric insurance is inexperienced and undercapitalized. Stakeholders lack the skills and knowledge needed to create parametric insurance plans. This has an impact on the process of implementation and adoption. People will not buy a thing if they do not understand it, so education is crucial (Charles, 2012). There are difficulties with the product design. To accurately reflect the risks faced by an insured, according to Charles (2012), appropriate parameters must be employed. Furthermore, the procedure is made more difficult by a lack of data on dangers and previous loss data. To complete the modeling process, some inputs are required. When it comes to risk reduction on a foundational level, quality counts. For example, the Caribbean once suffered from a lack of data and the relevant bodies, namely, Met Offices and disaster management agencies, which take the responsibility of recording the level of loss associated with varying intensity event

- Basis risk.

The most troublesome aspect of index insurance is basis risk. It's the gap between the payout determined by the index and the farmer's actual loss. Because index insurance does not require a field loss assessment, the payout is solely dependent on the index measurement, which may be larger or lower than the actual loss. Several factors determine the level of basis risk (Heimfarth & Musshoff, 2011). First, when the insured risk is correlated—that is, when it affects a big geographic area in a similar way and at the same time—basis risk is reduced. Hail and localized frost are two dangers that are poorly connected. Drought, temperature, and winds are better connected risks. Better correlated risks are drought, temperature, and winds. Second, basis risk is higher where there are local microclimates, different management

practices, and different crop varieties—that is, the weather risk may be correlated, but its impact is highly variable.

Despite its potential benefits, according to Sandland, Schilling, and Marke (2019), parametric insurance has a few drawbacks to consider. For starters, compensation are based on an index, so they may differ from real damage and losses. This 'base risk,' as defined by the World Food Programme and the International Fund for Agricultural Development (WFP and IFAD, 2012; Jensen, Barrett, and Mude, 2014), can result in damage and losses being under- or over-compensated. Because it's difficult to discover an index that's highly connected with real damage and losses, and thus reduces the 'base risk,' parametric insurance usually only covers a few types of natural disasters.

The restricts the scope of its operations. Parametric insurance also necessitates additional technical expertise in the areas of insurance product design and data collection and analysis. It requires frequent revisions to effectively record damage and losses and to include changing environmental conditions, which necessitates strong technical capabilities that many small and medium-sized insurance companies in developing nations lack (Franco et al., 2019). Data on a daily/hourly basis is also required for monitoring relevant parameters and determining rewards. As a result, in the event of WII, it may require a lot of help from weather stations, even though meteorological data from satellites can be useful.

- Data availability.

Despite the simplified data requirements, index insurance still requires accurate and full data sets. If the weather index is to serve as an accurate proxy for loss, this applies to the historical record of the chosen weather parameter(s) for underwriting and pricing purposes, as well as the recording of the parameter(s) for payout calculations during the period of insurance, as

well as historical yield data to assess risk, design, and price the product (Kusuma et al., 2019). A long and high-quality time series of meteorological data is necessary for weather index insurance (circa 30 years of daily data). According to Clarke (2011), the data required for index insurance may appear easy, but it is critical to have complete and reliable data. According to Charles (2012), with parametric insurance, it is necessary to develop acceptable parameters that are then utilized to accurately represent the risks encountered by the client. Because there is a lack of data on dangers and historical information, this process is made more challenging.

Integrity of weather stations.

To prevent tampering, weather stations used for index insurance must be suitably secure. They should also feature automatic data recording rather than human data recording. Data from weather stations will ideally be obtained utilizing automatic reporting methods such as Global System for Mobile Communications (GSM) devices (Heimfarth & Musshoff, 2011). These provisions not only improve the data's quality, but they also limit the risk of human error or data manipulation. The cost of the uncertainty loading that goes into the insurance premium is directly proportional to the degree of integrity. Weather stations must be protected to eliminate human manipulation when index insurance covers climate or weather-related hazards. According to Gine et al. (2008), automated weather stations are required to reduce manual data collection. To reduce human error and manipulation, data recording stations must be automated. In most circumstances, the degree of integrity has a direct impact on the additional premium increase caused by uncertainty loadings.

- **Regulatory approval**

In some jurisdictions there are no frameworks for index or parametric insurance. They are sometimes placed under one regulatory frameworks with traditional insurance products. This may create hurdles in being granted regulatory approval.

- **Additional technical capacity**

Parametric insurance necessitates a high level of technical expertise in the design of the insurance product as well as data collecting and analysis (Lucas, 2015). According to ESCAP (2015), when it comes to accurately capturing losses, incorporating the changing environment, and ongoing data collection for index monitoring, index insurance often necessitates frequent adjustments, which necessitates high technical capabilities that most companies in developing countries lack.

2.4 Empirical evidence

Most of the pilot projects have mainly focused on providing cover for the agriculture sector against natural catastrophic risks. The following are excerpts of parametric programmes adopted by other countries.

2.4.1 Malawi weather insurance

Drought has plagued the country four times in the last four decades, according to Margalescu and Margalescu (2013). Drought damage reached catastrophic levels for both society and Malawian agriculture. Drought not only caused crop failures, but it also put food supplies and incomes at jeopardy. Malawi began its pilot initiative in 2005, according to Hazel and Hess (2010), with farmers specialized on maize and groundnuts. Because local insurers were unwilling to underwrite the parametric policy, the Malawi Insurance Association volunteered

to test the pilot among its members. According to Hess and Syroka (2005), data collection was done form five weather stations and the data was on historical yields of 40 years back.

The majority of microfinance organizations chose to participate in the pilot and worked as aggregators, providing loans to farmers with the assurance that the insurance plan would protect them (Hess and Syroka, 2005). Farmers' insurance coverage were combined with loans. The test pilot project failed because local farmers who were selling farm produce on the side altered yields. The next season, the number of farmers insured for maize and groundnuts increased to 2000 and 1800, respectively. The loans given by microfinance companies were largely responsible for this. Despite this, farmers continued to influence yields by selling agricultural produce on the side.

To address all of these concerns, Malawi's government considered or decided to offer index-based insurance as a drought-relieving strategy. It was the first sovereign African country to use such a tool in 2008. Malawi's government, with the assistance of the World Bank, developed a weather derivative that aided maize farmers in better managing with the financial effects of droughts (Margalescu and Margalescu, 2013). SwissRe also entered into a transaction with the World Bank as a counterparty. The reinsurer (SwissRe) agreed to pay USD 5 million based on the contract's terms.

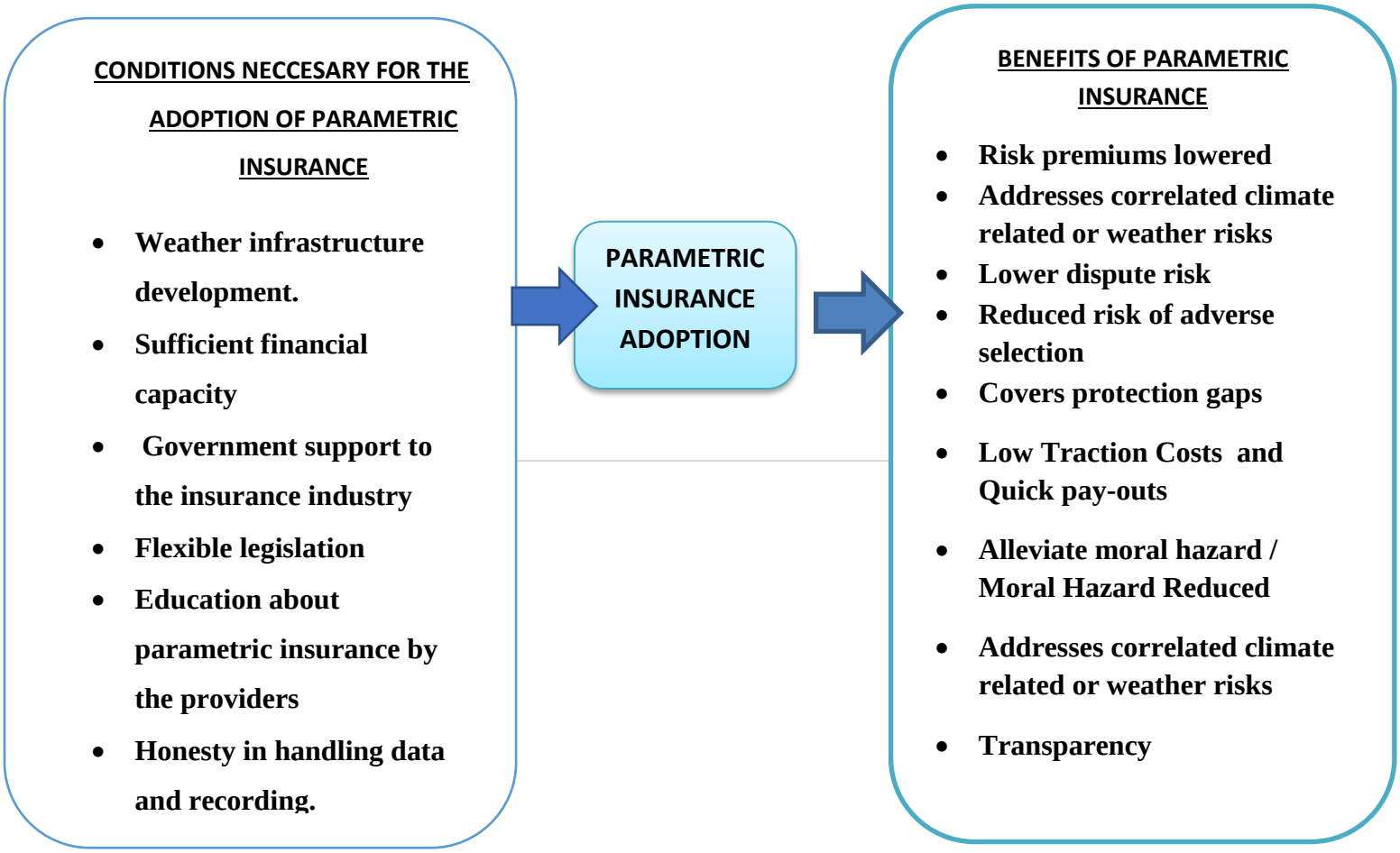
2.4.2 Bangladesh (meso-level) index based flood insurance

Bangladesh started a trial project in 2013 to provide flood insurance based on a hydrodynamic model and water levels. The premiums are paid by the homes, and each household pays a total of USD $10. According to Lucas (2015), the pilot project has 1,661 households spread out over 14 villages. When there are floods that exceed a predetermined

water level, the payouts are triggered. Floods that persist 10 days and exceed the predetermined water levels result in a payment of USD $36 per home, with the sum increasing to USD $100 if the floods last 26 days or longer.

The pilot project initiator is Oxfam and the funding of the project comes from the Swiss Agency for Development and Cooperation (SDC). Manab Mukti Sangatha is the implementing non-governmental organization and it is jointly partnered by Institute of Water Modelling, CIRM Advisory Services (India), and Pali Karma Sahayak Foundation. The joint implementers and insurers are SwissRe and Pragati Insurance Ltd with shares of 80% and 20% respectively. In the year 2014, the scheme made a payout to 700 families or households after significant damages were caused by floods in several villages (Lucas, 2015; SwissRe, 2016). The total amount paid was USD $ 250, 000.

2.5 Conceptual framework



2.6 Chapter Summary

The chapter discussed and reviewed pertinent literature published on parametric or index insurance by various authors and researchers. The literature on, parametric (weather) insurance and the risk management process was examined in detail. In addition, the structuring and designing of index insurance was also explained, the merits and challenges of implementing parametric insurance were outlined and also including scaling up of index insurance for developing countries like Zimbabwe. Last but not least, case studies on parametric insurance for weather related risks by other countries were cited. There is need to employ research methods and the next chapter focuses on that

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

An effective research strategy is dependent on selecting the appropriate methodology (Saunders et al, 2009). Hence, the purpose of the current chapter is to provide a descriptive argument for the methods to be adopted to analyse the practicability of parametric insurance in Zimbabwe. In the following sections of the methodology chapter, rationale for the approach adopted, research design, types of data sources and methods used for collecting the data, population under study and sampling procedure and analysis procedure is explained in detail.

3.2 Research Design

The research design is based on a descriptive study method whereby as a research instrument structured survey questionnaire was adopted. In order to complete the research-process a Twostep research design was adopted. As per Chintalloo&Mahadeo (2013), there are several quantitative studies that have adopted a two-step research design. In such a design, a pilot study will be conducted in the first step and the main survey is conducted in the second step. In order to eliminate any errors and also increase the clarity, reliability and validity for the research it is vital that researchers adopt the abovementioned research design test. The researcher has used a descriptive approach in the current study. The main reason for adopting a descriptive study is mainly due to answer research questions relevant for the study and to find specific factors on the practicability of parametric insurance in Zimbabwe.

3.3 Research Approach

(Cameron 2015) defines mixed approach as research that involves collecting, analyzing and interpreting quantitative data in a single study or in a series of studies that investigate the same underlying phenomenon This study will use mixed methods approach that involves collecting, analyzing and integrating quantitative (surveys) and qualitative (interviews) to obtain the on the practicability of parametric insurance in Zimbabwe.. This will be attained through gathering information pertaining to targeted population on particular subject and analyzing information to observe on the practicability of parametric insurance in Zimbabwe.

Creswell (2013) Quantitative methods emphasizes objective measurements and the statistical mathematical, or numerical analysis of data collected through polls, questioners and surveys or by manipulating pre-existing statistical data using computational techniques. Quantitative methods are used to examine the relationship between variables with the primary goal being to analyse and present the relationship mathematically through statistical analysis. Statistical analysis allows for greater objectivity when reviewing results and therefore, results are independent of the researcher. Numerical quantitative data may be viewed as more credible and reliable, to policy makers' decision makers and administrators. Qualitative Research Is a method of inquiry employed by different academic disciplines, qualitative methods examine why and how of decision making, not just what, where, when, who Plano and Ivanok(2016) Design generally based on social constructivism, research problems became research questions sample sizes can be small as one. Data collection involves interview, observation and archival data. Sharan and Tisdel(2015) cite that It is used to gain an understanding of underlying reasons, opinions and motivations. Qualitative research is also used to uncover trends in thought and opinions and dive deeper into the problem.

Mixed methods have an integration component which give readers more confidence in the results and the conclusions drawn from the study. This research objectives include both qualitative and quantitative objectives in assessing the on the practicability of parametric insurance in Zimbabwe.. Mixed methods add value by increasing findings, informing the collection of second data source and assisting with new knowledge, the approach gains broader understanding of the phenomenon than studies that do not utilize both a quantitative and qualitative approach (Mckim 2017). Mixed research provides strengths that offset the weakness of both quantitative and qualitative research, by using both types the strengths of each approach can make up for the weakness of the other (Cameron 2015).

3.4 Study population

The study population consists of individuals with which the researcher will draw answers to the research questions from, obtain information from and make conclusions from. According to Sekram (2000) a study population is referred to as a group of individuals, people or subjects whose features or characteristics are similar such as in the same type of business. As indicated by the Insurance and Pension Commission (2019) there are eight reinsurance companies in the Zimbabwean short term insurance sector. The insurance and Pension Commission is the regulator of all insurance companies operating in Zimbabwe. IPEC discharges its mandate through controlling and monitoring the activities of insurance companies operating locally. For this research, the study population comprises of eight registered reinsurance companies in the local market and the government of Zimbabwe represented by its arm IPEC. The study population is made up of eight companies.

3.5 Sampling and sampling techniques

3.5.1 Sampling techniques / methods

According to Leedy and Ormrod (2016) sampling a way of obtaining useful information about a particular population without having to examine each and every subject matter. Saunders, Creswell (2014) stated sampling entails consideration of a variety of methods that aim to condense the amount of data collected from population. According to Saunders et al. (2009) there are two types of sampling techniques which are probability sampling and nonprobability sampling. Probability sampling is the type of sampling where each case from a population has an equal chance of being selected. Sekeran and Bougie (2009) alludes that probability sampling consists of four methods which are simple random, cluster, stratified and systematic sampling. Contrary non probability sampling is where the chance of each element to be selected from the population is not even known. It is also referred to as non-random sampling. According to Saunders (2011) the selection criteria on non-random sampling is influenced by factors and two methods are normally which are snowball and convenience sampling.

The researcher made use of samples in the view of cost saving and time constraints. The research used sampling techniques that fall under probability sampling that is stratified sampling and simple random sampling. Judgmental sampling which is a non-probability sampling technique was also used. Sharan and Tisdel (2015) defines non-probability sampling as, “a method of selecting samples in which the choice of selection of sampling units depends on the discretion or judgment of the researcher.

3.5.2 Sample size

According to Jankowicz (1995) a sample is defined as a thoughtful choice of people who will provide data from which conclusions are drawn on the population they represent. Thomas (2003) cites that it is a subsection of the entire population. Kumar (1999) reinforced that a

sample alludes to a subset of the study population and is selected for the purposes of carrying and completing out a survey.

According to Yamane (1967), a sample size is determined by applying a formula. The formula suggested was used to come up with the sample size from eight (8) local reinsurance companies. The formula and calculation is shown below:

$$\mathbf{n} = \frac{N}{(1+N(e)^2}$$

Where n = the sample size

N = the population size

E = margin of error or precision level

A 90 % confidence level was used by the researcher and the precision level is 10%.

Therefore: n = $\frac{8}{1+8(0.1)^2}$

n = 7

Based on the above answer calculated using the Yamane's formula, 7 reinsurance companies were selected to represent 8 reinsurance companies. The sample size included seven reinsurers and IPEC. According to Saunders (2011) the larger the sample size the smaller the precision error and hence a 90 % confidence level was employed.

3.6 Sources of Data

3.6.1 Primary Data

Primary is information that you collect specifically for the purpose of your research project. An advantage is that it is specifically tailored to research needs (Cameroon 2015). The major disadvantage is that it is expensive to obtain. The source of its data is the population sample from which you will collect the data. Data is collected through questionnaires, focus groups, surveys and interviews. Primary data are original and relevant to the topic of the research study so the degree of accuracy is very high. It can be collected from a number of ways like interviews, telephone surveys, focus groups etc. It includes a large population and wide geographical coverage. Primary data is current and it can give a realistic view to the researcher about the problem statement. Reliability of primary data is very high because these are collected by the concerned and reliable party since it is collected from source. It is more closely linked to the field and is not collected through a process of filtering that is used in secondary sources

3.6.2 Secondary Data

Secondary data comprises of data that was collected by someone other than the user. The advantage of secondary analysis of existing data is the low cost Cameroon (2015). It can either be it can be external, which is also from outside sources or internal that is in-house data. Secondary data will be essential in carrying out the research although primary data provides the solution to the problem. The researcher will use secondary data because it provides with a starting point for further analysis to analyse the practicability of parametric insurance in Zimbabwe.

3.7 Research Instruments

3.7.1 Questionnaires

Creswell (2014) a questionnaire is a research instrument consisting of a series of questions for the purpose of gathering information from respondents. It serves the following puporses (1) collect appropriate data, (2) make data comparable and amendable to analysis and minimize bias in formulating and asking question. Questionnaires are to be designed and distributed by the researcher, the questionnaires will contain questions designed to gather the required information and to be completed by the respondents the questionnaires will have questions that are to be responded to and these questionnaires are to be included at the back of the chapter. The researcher required a written response through a tick, one word or few words response. The researcher will use questionnaires because they are time saving and can retrieve data in a short space of time.

Advantages

a) Questionnaires are cheap and the researcher won't incur high travel and convenience expenses.

b) They are easy to administer and allows quick response and provide anonymity of respondents which then encourages them to give honest opinions.

c) Large volumes of information can be collected from a large sample in a short period of time and in a cost effective manner.

d) They reduce interview bias. Personal questions maintain uniformity, are often more willingly answered and the responded is not face to face with the researcher.

Disadvantages

a) Questionnaires may introduce sample bias and can reduce the sample size especially when questions are left unanswered.

b) Targeted respondents may fail to answer the questionnaires. Taking for instance a personal assistant completing the questionnaire on behalf of a manager who has a tight schedule (busy).

c) The respondents may discuss questions with others before completing questionnaires and this may result in biased answers as well as failure to get spontaneous answers.

d) The respondents may fail to clearly understand the questions and it becomes more difficult when the researcher in not present.

3.7.2 Personal interviews

Burns (1997) posits that an interview is a formal meeting arranged between an interviewer and an interviewee. Cresswell and Clark (2007) postulates that using interviews is an exceptional method of research, on the other hand it demands that individuals must be highly knowledgeable in the area under study. Interviews enable open conversations between the interviewer and interviewee in a one on one session and this prompted the researcher to opt for interviews. Through the use of interviews the researcher could get ideas, probe responses and get investigation motives, something that questionnaires cannot offer.

Advantages of Interviews

- **a)** Higher response rate as compared to questionnaires.
- **b)** They are flexible since the questions can be restructured.

c) The researcher benefits more from face to face communication with the interviewee and there is room to clear misunderstandings and the researcher can also ask probing questions.

d) Enables the interviewer to encourage the interviewee to respond fully or make sure if the question is correctly understood

Disadvantages

a) Interviews are time consuming especially when the sample is large and involves time for revising the collected information and recalls of respondents are to be made.

b) They are relatively costly especially when a large and widespread geographic sample is used.

c) Possibility of bias between interviewer and respondent is high especially when the respondents answers in a way to please the interviewer instead of doing it in an honest and factual manner.

d) Interviews may introduce systematic errors.

3.8 Validity and Reliability

Creswell (2014) Validity is the extent to which values provided by an instrument actually measure the attributes it is intended to measure. That is the instrument used should measure what it is intended to measure. Sampling validity refers to the degree to which the samples are ample sample of the total population. Content validity refers to the degree in which the sample test items represent the content that the test is designed to measure. Reliability is the degree of consistence that is demonstrated by the procedure employed in a study to give

reliable estimates, Cameron (2015) . Reliability refers to the extra to which a test is consistent or dependable in measuring whatever it is intended to measure. The questionnaires to be distributed will contain same questions that could be used for comparison of responses that were given by individuals.

3.9 Data analysis and presentation

3.9.1 Data presentation

Sharan and Tisdel (2015) cited that the purpose of conducting a quantitative study, is to produce findings, whereas qualitative methods use words to construct a framework for communicating the essence of what the data reveal, procedures and techniques are used to analyze data numerically, called quantitative methods. When sorting the data, the researcher will drop disturbing outliers and ignore non- responses. The collected data will be cleaned through inspection and erroneous data will if necessary, be possibly corrected. After collecting the data, the researcher will collate the data and group it according to thematic responses. The data will be presented mainly by graphical means and through cross tabulation. The researcher will compare and test for variance the data by analyzing frequencies on tables and graphs. Microsoft Excel will be used in the construction of pie charts, tables and graphs. Principally, the data will be prepared, organized, reduced into subjects through a process of coding and then eventually presented in figures, tables, pie charts, discussions and graphs.

3.9.2 Data Analysis

The data to be collected will be edited for accurateness, dependability and effectiveness and then evaluated using the inferential and descriptive statistics with the assistance of the

Statistical Package for Social Studies. Descriptive statistics will be including measures of fundamental tendency like the mean, percentages and the standard deviation while inferential statistics will be used to come up with conclusions

3.10 Ethical Considerations

The researcher is going to try and adhere to ethical guidelines as much as possible.

Informed consent

Before carrying out the research, the researcher is going to inform the respondents about the reason for conducting the research through a consent form. The participants will be allowed to voluntarily participate in the study. No coercion or duress is going to be used in the study. In addition, the respondents will have absolute freedom of choice of whether to continue with the research or not.

No harm to participants

In the consent form the research is going to ensure the respondents that they are not going to get any harm because of participating in the research. The researcher will strongly emphasise that the information that is going to be obtained is going to be used for academic purposes only.

Confidentiality and anonymity

Confidentiality will be maintained throughout the study. The researcher is going to have a non-disclosure of confidential information agreement with the participants. In addition, the study is going to use numbers to reflect the respondents and the real names of the participants will not be used.

Permission

The researcher is going to ask for permission before conducting the research from the relevant authorities and respondents who are going to participate in the study. The respondents will be asked to sign a consent form before taking part in the study as an indication that they are agreeing to participate.

3.11 Chapter Summary

This chapter looked at the various research methods which were used to gather data that was required to investigate the adoptability of parametric insurance in the Zimbabwean market. The research design, study population, sampling techniques and sample size, and finally the research instruments and data collection techniques were also explained in this chapter. The collected data and research findings will be presented in the following chapter.

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents and analyzes data collected from the research on of practicability of parametric insurance in Zimbabwe. The chapter provides responses obtained from the distribution of questionnaires. Questionnaires were administered to the respondents. This chapter also presents the response rate, demographics of the respondents and the research findings. The researcher adopted graphical presentations to present data.

4.2 Response Rate Analysis

The researcher managed to distribute a total of 14 questionnaires to 7 reinsurance companies which constituted the chosen sample. Two questionnaires were sent per each company and a total of 12 questionnaires were returned making a response rate of 86 %. The questionnaires were directed to the operations unit of each company. In addition, an interview with the regulator, Insurance and Pension Commission was successfully conducted. The response rate is presented in the table below

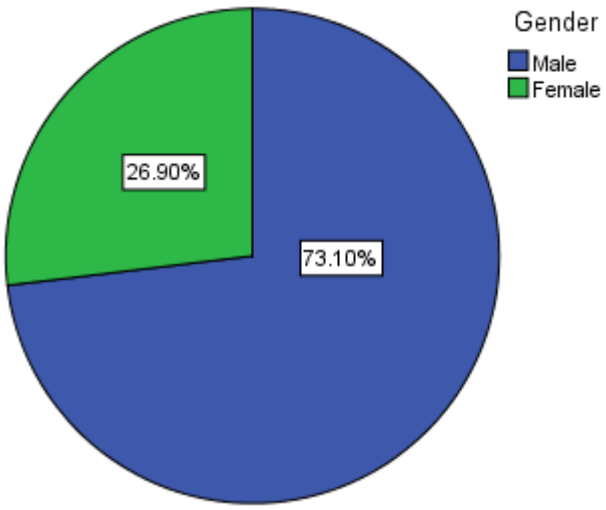
Table 4.1 Response Rate

Respondents	Questionnaires dispatched	Questionnaires returned	Response rate as a %
Reinsurance Co	14	12	86

According to Mugenda and Mugenda (2003) a 50% response rate is adequate, 60% good and above 70% rated very good. This also collaborates Bailey (2000) assertion that a response rate of 50% is adequate, while a response rate greater than 70% is very good. The high response rate can be attributed to the data collection procedures, where the researcher pre-notified the potential participants and applied the drop and pick method where the questionnaires were picked at a later date to allow the respondents ample time to fill the questionnaires

4.3 Gender of the respondents

A case study of the practicability of parametric insurance in Zimbabwe needs input from both males and females. Figure 4.1 is a summary statistic of the gender of the respondents



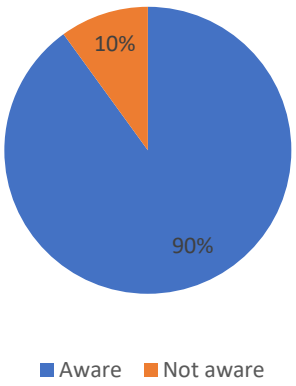
The study was dominated more with male respondents than female respondents. Even females were few, however, they are significantly represents as indicated by their percentage statistics

4.4 TO EXPLORE THE PRACTICABILITY OF PARAMETRIC INSURANCE IN ZIMBABWE

4.4.1 Awareness of parametric insurance

The question sought to find out if the local reinsurers knew about parametric insurance. 90 % of the respondents knew of this type of insurance and only at total of 10% were not aware. This shows that in our reinsurance market, the majority are aware of parametric or index based insurance. The findings are presented below;

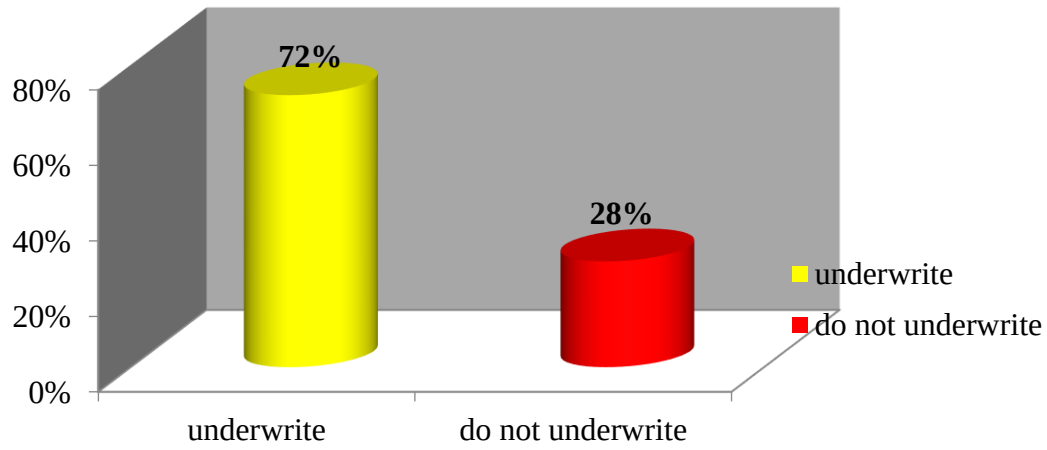
Fig 4.2 Parametric insurance awarenes



4.4.2 Underwriting natural disasters

The question sought to investigate if reinsurance companies in the Zimbabwean market were underwriting natural disaster risks. The results are presented on the figure below;

Figure 4.3: Underwriting natural disasters



72% of the respondents made a confirmation that natural disasters were underwritten and the remaining 28% were not. The 28% suggested the reasons why they were not underwriting natural disasters. These reasons include, financial incapacity, high levels of uncertainty when

it comes to appropriate pricing by insurers (cedents) and they also cited that insurer were limiting their retention levels and this have an impact on the concept of spreading risks

4.4.3 Natural disasters currently covered and their relevant insurance products

The researcher intended to find out the natural disasters that are currently covered in the Zimbabwean market and under which insurance product. The findings are summarized on the table below;

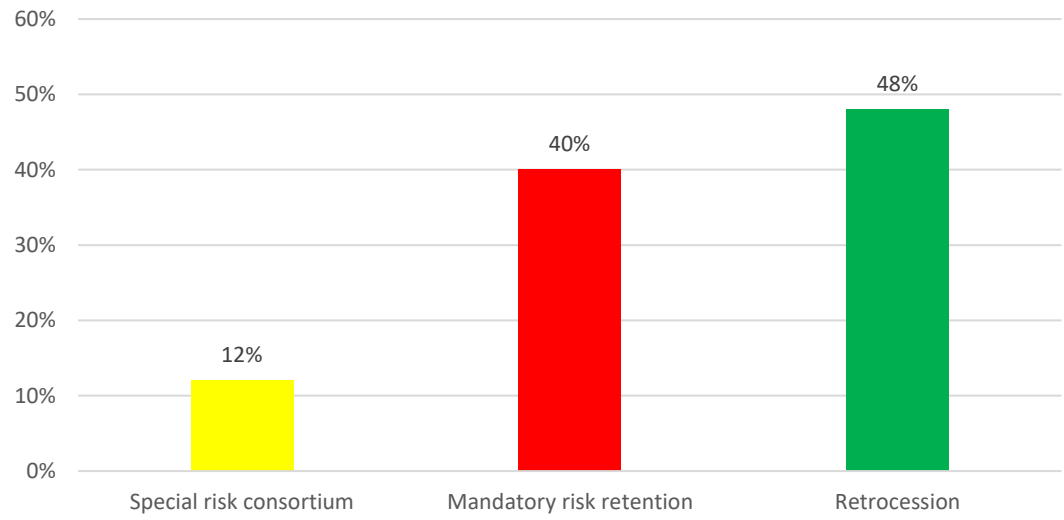
Insurance product	Covered perils
Crop insurance	It covers crop failure on growth, area yield and even on transportation of crops to the market. Crop damage as a result of hail, flooding, storm and rainfall
Property insurance	It covers property or material damage against fire, lightning, earthquake, flooding, hurricanes and hail or snow.

72% of the respondents confirmed that disaster risks were being covered under property insurance covering fire, lightning, earthquake, flooding, hurricanes and hail/snow. The other product indicated was crop insurance which provides cover for hail or snow, rainfall, flooding and storms.

4.4.4 What strategies are employed in managing catastrophic accounts?

The question intended to find out the strategies that are employed by reinsurance companies in managing catastrophic portfolios or accounts.

Fig 4.4 Strategies used to manage catastrophic risk accounts(portfolios)

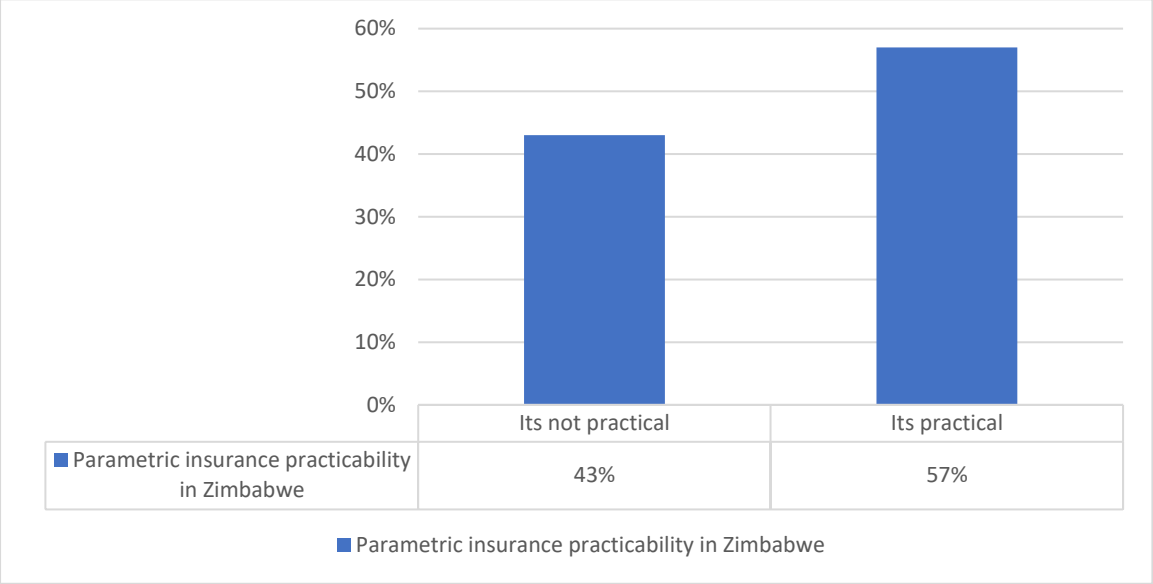


The respondents mentioned the three main strategies used to manage catastrophic accounts which are imposing mandatory retention (cedent retention), retrocession and use of the special risk consortium which is administered by the Insurance Council of Zimbabwe. 40% of the reinsurance companies cited that they are imposing mandatory retention which depends on the insurer's capacity thus retention levels can either be high or low. 48% of the reinsures indicated that they were using retrocession. According to Voss Law Firm (2017) retrocession refers to the insurance type in which reinsurers transfers all or part of their risks to other reinsurance companies in the local or outside market. The remaining 12% used the special risk consortium as a strategy.

4.4.5 Parametric Insurance practicability in Zimbabwe

The researcher asked the question with the intention of finding out the views of the respondents on whether it was practical to adopt parametric insurance in Zimbabwe. Fig 4.6 below present the findings:

Figure 4.5 Parametric Insurance practicability in Zimbabwe



43% of the respondents indicated that it was practical and the remaining 57% indicated that it was not practical. The 43% of the respondents who were in agreement that it is practical pointed out that the developments which are currently taking place in the country will be success pillars. Such developments include the growth of agriculture micro insurance for small scale farmers currently offered by Old Mutual Insurance and other micro insurance companies, Ecofarmer a pilot project which is in joint partnership with the Meteorological Service Department where daily weather reports are provided to farmers on daily basis. On

the other hand, the 57% indicated that the local market does not have the capacity to shoulder such cover and it lacked expertise and technical knowledge and skills.

4.5 TO CREATE A SOLID GROUND FOR THE ADOPTION OF PARAMETRIC INSURANCE IN ZIMBABWE

One of the objectives was to create a solid ground for the adoption of parametric insurance in Zimbabwe through providing the conditions necessary for the adoption of parametric insurance. Respondents were asked to indicate their level of agreement on the following conditions shown on the table below;

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total	MEAN	SD
Weather infrastructure development.	10%	14%	17%	25%	34%	100%	**2.2708**	**1.1932**
Sufficient financial capacity	9%	15%	12%	22%	42%	100%	**2.2500**	**1.1932**
Government support to the insurance industry	16%	9%	7%	51%	17%	100%	**2.2708**	**1.2105**
Flexible legislation	10%	7%	8%	39%	36%	100%	**2.2812**	**1.2039**
Education about parametric insurance by the providers	16.95%	6.78%	20.34%	49.15%	6.78%	100%	**2.2604**	**1.1955**
Honesty in handling data and recording.	11%	18%	15%	21%	35%	100%	**2.2396**	**1.1911**

4.5.1 Weather infrastructure development.

The table above shows that 14% and 10% of the respondents disagreed and strongly disagreed respectively that a solid ground for the adoption of parametric insurance is necessitated by ensuring weather infrastructure development environment. 17% of the respondents were not sure whether they agree or not. 25% and 34% of the respondents agreed and strongly disagreed respectively a solid ground for the adoption of parametric insurance is necessitated by ensuring weather infrastructure development environment. The results imply that the majority of the respondents agreed that a solid ground for the adoption of parametric insurance is necessitated by ensuring weather infrastructure development environment.

4.5.2 Sufficient financial capacity

Table 4.4 indicates that 15% and 9% of the respondents disagreed and strongly disagreed that a solid ground for the adoption of parametric insurance is necessitated by ensuring sufficient financial capacity. 12% of the respondents were not sure. 22% and 42% of the respondents agreed and strongly agreed respectively. Basing on the findings indicates that that a solid ground for the adoption of parametric insurance is necessitated by ensuring sufficient financial capacity

4.5.3 Government support to the insurance industry

Table 4.4 outlines that 9% and 16% of the respondents disagreed and strongly disagreed respectively that a solid ground for the adoption of parametric insurance is necessitated by ensuring government support to the insurance industry. 7% of the respondents were not sure. 51% and 17% of the respondents agreed and strongly agreed. The research findings indicates that majority of the respondents were of the opinion that that a solid ground for the adoption

of parametric insurance is necessitated by ensuring government support to the insurance industry.

4.5.4 Flexible legislation

Table 4.4 shows that, 7% and 10% of the respondents disagreed and strongly disagreed respectively that that a solid ground for the adoption of parametric insurance is necessitated by ensuring flexible legislation. 8% of the respondents were not sure. 39% and 36% of the respondents agreed and strongly agreed respectively. The study implies that most (75%) of the respondents were of the opinion that that that a solid ground for the adoption of parametric insurance is necessitated by ensuring flexible legislation.

4.5.5.Education about parametric insurance by the providers

From the above figure 4.17 shows that 6.78% and 16.95% of the respondents disagreed and strongly disagreed respectively that a solid ground for the adoption of parametric insurance is necessitated by ensuring that education about parametric insurance by the providers is spread. 20.34% of the respondents were not sure whether they agree or not. 49.15% and 6.78% of the respondents agree and strongly agree respectively. Basing on the findings, the majority (55.93%) of the respondents agreed that that a solid ground for the adoption of parametric insurance is necessitated by ensuring that education about parametric insurance by the providers is spread.

4.5.6 Honesty in handling data and recording.

The table 4.6 above presents that 18% and 11% of the respondents disagreed and strongly disagreed that a solid ground for the adoption of parametric insurance is necessitated by

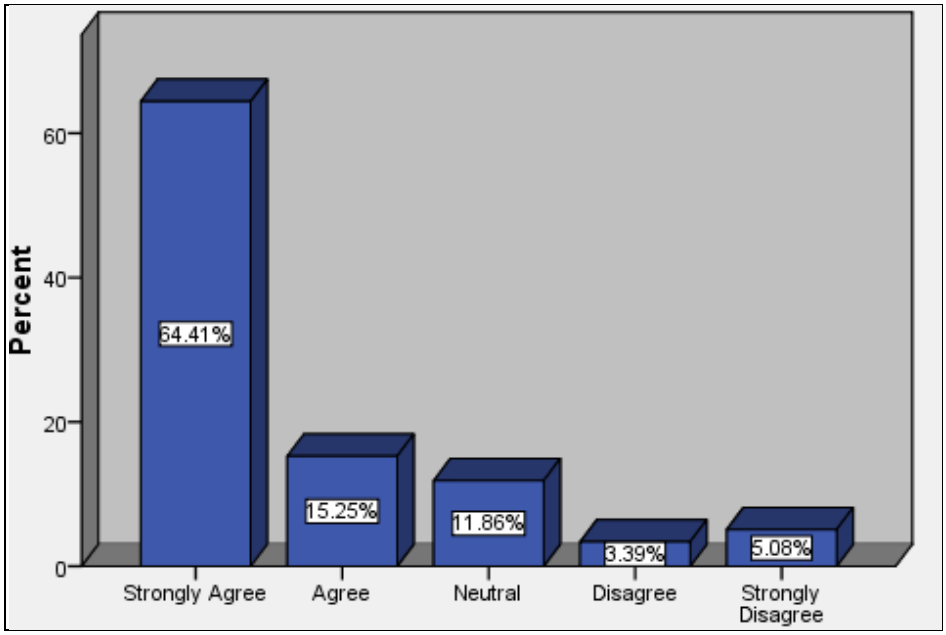
ensuring honesty in handling data and recording. 15% of the respondents were not sure if whether they agree or not. 21% and 35% of the respondents agreed and strongly agreed to the statement. The study results presents that the majority of the respondents agreed that a solid ground for the adoption of parametric insurance is necessitated by ensuring honesty in handling data and recording.

4.6 TO ANALYZE THE MERITS AND OF ADOPTING PARAMETRIC INSURANCE

One of the objectives of the study the merits of adopting parametric insurance in Zimbabwe. The respondents were asked to indicate their level of agreement concerning the benefits such as risk premiums lowered, addresses correlated climate related or weather risks, lower dispute risk, reduced risk of adverse selection, covers protection gaps, low traction costs and quick pay-outs, alleviate moral hazard / moral hazard reduced, addresses correlated climate related or weather risks and transparency.

4.6.1 Risk premiums lowered

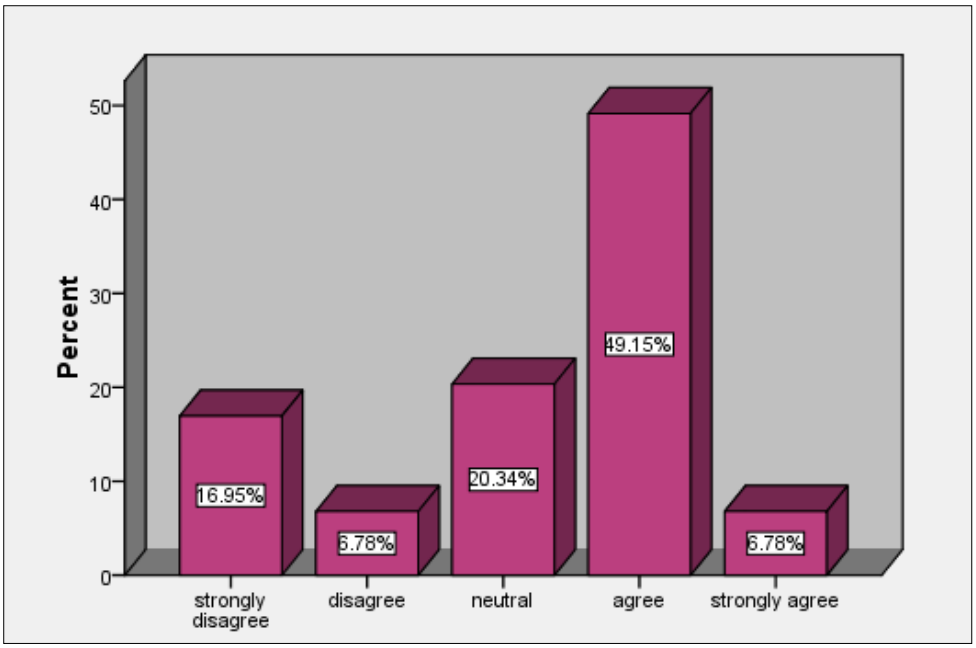
Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance comes with risk premium lowered. The respondents are presented below;



As shown in Figure above 64.41% of the respondents strongly agree that the adoption of parametric insurance comes with risk premium lowered. 15.25% of the respondents and 11.86% of the respondents agree and not sure respectively. 3.39% and 5.08% of the respondents disagree and strongly disagree respectively that that the adoption of parametric insurance comes with risk premium lowered. These results indicate that the majority of the respondents concur with the view that the adoption of parametric insurance comes with risk premium lowered.

4.6.2 Addresses correlated climate related risks

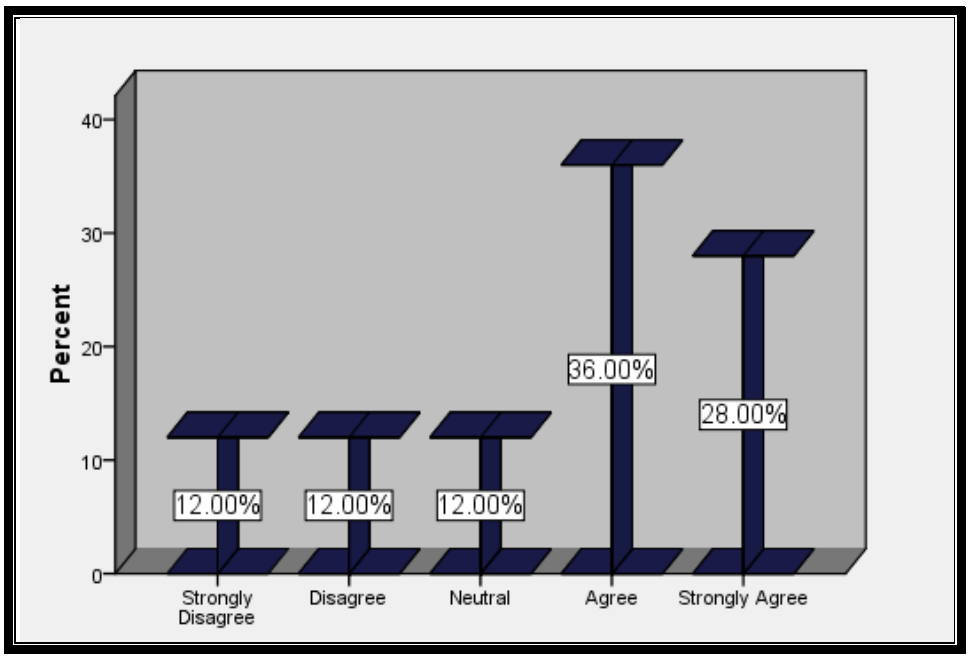
Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance addresses correlated climate related risks. The respondents are presented below;



From the above figure 4.17 shows that 6.78% and 16.95% of the respondents disagreed and strongly disagreed respectively the adoption of parametric insurance addresses correlated climate related risks. 20.34% of the respondents were not sure. 49.15% and 6.78% of the respondents agree and strongly agree respectively the adoption of parametric insurance addresses correlated climate related risks. Basing on the findings, the majority (55.93%) of the respondents agreed the adoption of parametric insurance addresses correlated climate related risks.

4.6.3 Lower dispute risk

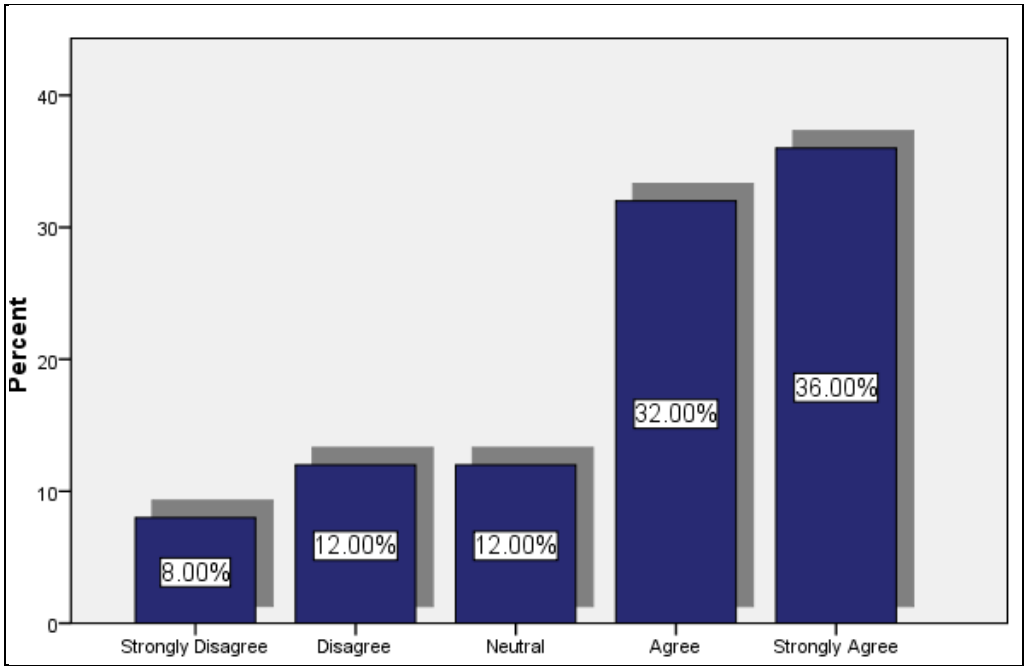
Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance lower dispute. The respondents are presented below;



Basing on the responses from the employees it shows that 36% of the respondents agree that use the adoption of parametric insurance lower dispute and they were supported by other 28% of the respondents who strongly agreed. Few respondents (12%) were not sure while only 12 % of the respondents cited that they disagree and strongly disagree respectively the adoption of parametric insurance lower dispute. The research finding implies the adoption of parametric insurance lower dispute.

4.6.4 Covers protection gaps and addresses transparency

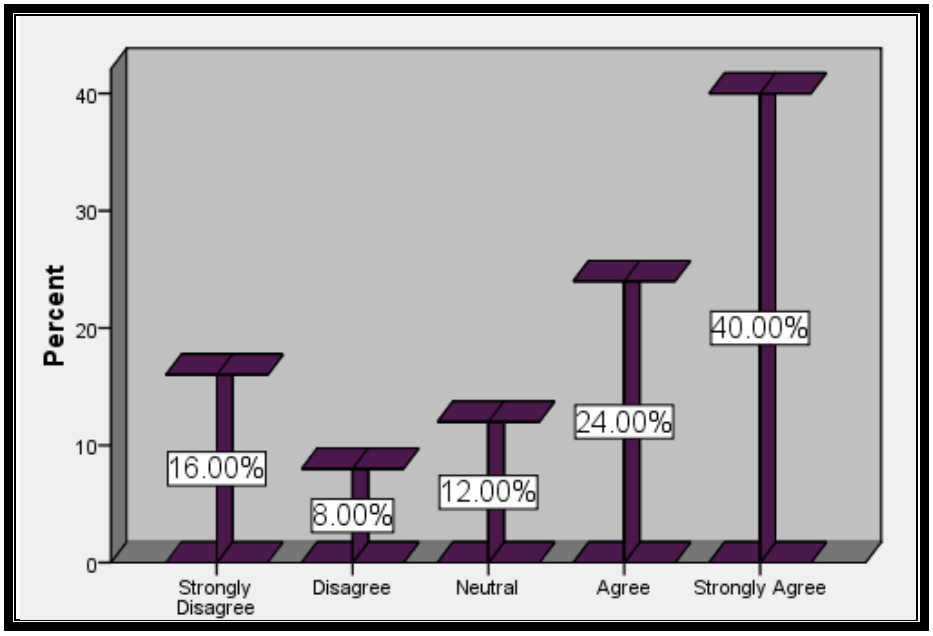
Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance comes with covers protection gaps and addresses transparency. The respondents are presented below;



Basing on the research findings presented in the figure 4.6 above, the researcher found out that that the adoption of parametric insurance comes with covers protection gaps and addresses transparency as the majority of the respondents 36% strongly agreed and the notion was supported by 32% of the respondents who also agreed. Only few respondents (8%) disagreed to the statement and they were supported by 12% of the respondents. Research findings imply that that the adoption of parametric insurance comes with covers protection gaps and addresses transparency

4.6.5 Low traction costs and quick pay-outs

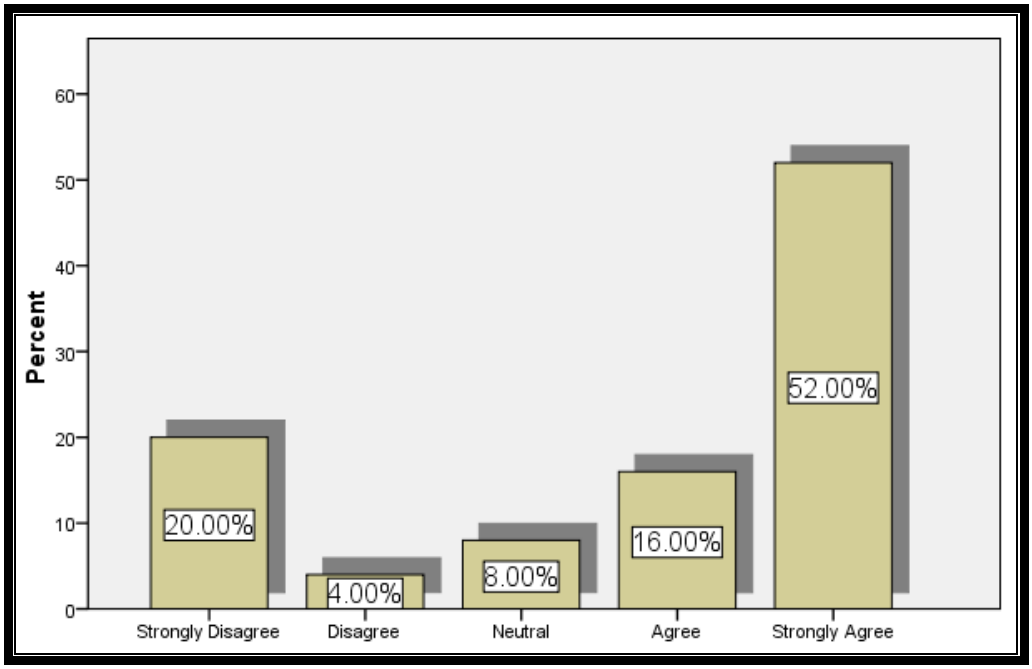
Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance comes with low traction costs and quick pay-outs. The respondents are presented below;



The researcher found out that 16% of the respondents strongly disagree and they were supported by 8% of the respondents who cited the adoption of parametric insurance comes with low traction costs and quick pay-outs. The researcher also found out that 12% of the respondents were not sure while the majority of the respondents 24% agreed and they were supported by 40% of the respondents who also strongly agreed the adoption of parametric insurance comes with low traction costs and quick pay-outs. These findings imply that the adoption of parametric insurance comes with low traction costs and quick pay-outs.

4.6.6 Alleviate moral hazard

Respondents were asked to indicate their level of agreement to the statement that to what extent do you agree that the adoption of parametric insurance comes with reduced moral harzard. The respondents are presented below;



The researcher found out that 20% of the respondents strongly disagree and they were supported by 4% of the respondents who also disagrees the adoption of parametric insurance comes with reduced moral hazard. The majority of the respondents 52% strongly agree to the statement that the adoption of parametric insurance comes with reduced moral hazard. Basing on the research findings it implies that the adoption of parametric insurance comes with reduced moral hazard.

4.7 TO ANALYZE THE CHALLENGES AND OF ADOPTING PARAMETRIC INSURANCE

4.7.1 Main reasons why reinsurers in the local do not consider underwriting index insurance.

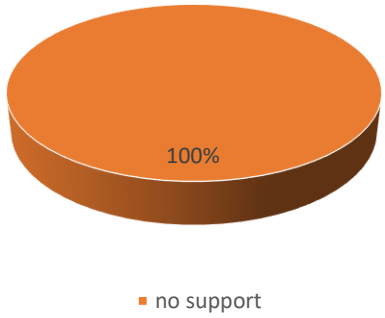
The question sought to investigate the major reasons why local reinsurers are not considering to underwrite index-based insurance covering weather related perils. 86% of the respondents suggested the following reasons pertaining to why they were not underwriting parametric weather insurance. The reasons are outlined below

Reason mentioned	Explanation
Financial restrictions	this was cited as the main reason due to the fact that weather or climate related perils are catastrophic in their nature and if claims are to occur, they may bankrupt the reinsurance companies
Lack of technical skills	parametric insurance requires technical knowledge and skills and in the local market such skills are limited
Administration concerns	parametric insurance contracts are technical and requires close monitoring, constant trainings and alteration of processes

4.7.2 Government's backing for catastrophic risk underwriting

The researcher asked the question with the intention to find out if the local reinsurers were receiving any support from the government towards catastrophic risk underwriting.

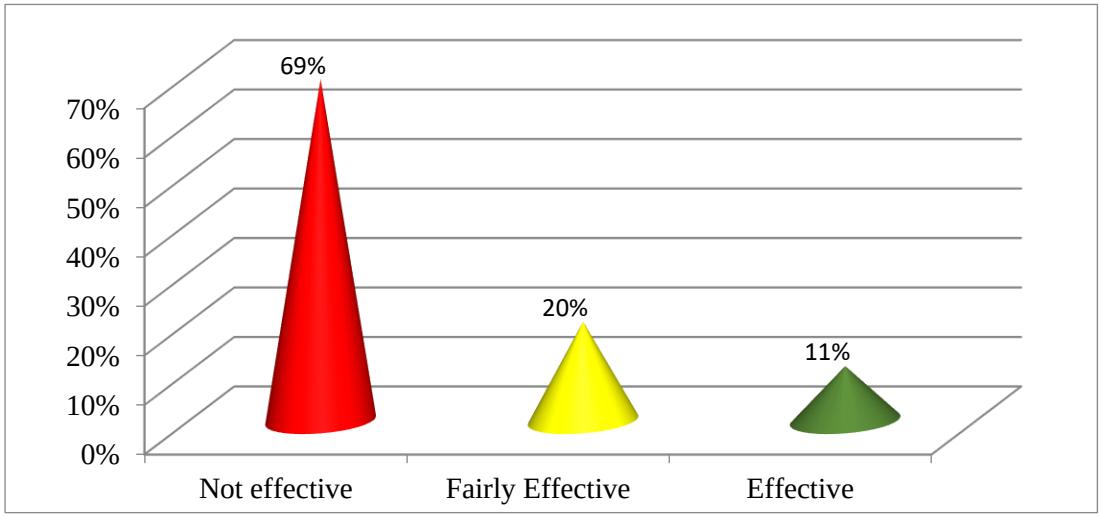
Fig 4.5 Government support in underwriting catastrophic risks



All the respondents confirmed that there was no backing or support from the government in terms of catastrophic risk underwriting.

4.7.3 Effectiveness of the government's natural disaster response

The question was meant to find out the views of the respondents on the government's response was effective especially on scenarios where they offer disaster relief when disasters such as flooding and drought strike.



Rating the effectiveness of government's disaster response

69% of the respondents indicated that the government's response to disaster relief was not effective, 20% indicated that it the remaining 11% were in the view that the government's response was effective. 69% of the respondents who cited that it was not effective mentioned the following reasons:

a) Government's failure to provide immediate evacuation and resettlement as soon as possible after a disaster.
b) Shortage of food at holding camps
c) Improper accommodation.

4.8 APPLICABLE RECOMMENDATIONS TO THE PRACTICABILITY OF PARAMETRIC INSURANCE

4.8.1 Measures which are necessary for the successful adoption of parametric insurance for natural disasters.

The question was aimed at identifying the different views from the respondents on what they merely think is necessary for implementing parametric insurance for weather related perils. All of the respondents ascertained the following measures:

a) Developing the current infrastructure through secure and advanced meteorological stations.
b) Creation of an enabling environment in terms of regulatory approval and legislation.
c) Impartation of technical skills and knowledge especially on the underwriting side.
d) Full government support.
e) Sufficient funding so as to boost capacity.

4.8.2 Interview findings

The researcher managed to conduct interviews and the findings from the interviews are presented and analyzed hereunder.

Through the interviews conducted it was brought to light that natural disasters are currently being underwritten under two products namely crop insurance and property insurance. Crop insurance was deemed to be limited since reinsurers only choose to underwrite specific crops. In support of this view, reinsurers are also interested mostly in the commercial farmers operating at a large scale.

The respondents indicated that there was a standard guide or rating tables with rates for underwriting of natural disasters. The guides used provide assistance to insurance players in the process of underwriting such perils.

The insurance regulator IPEC had also considered to authorize the underwriting of natural disasters through weather index insurance but however the process is still at its development stage. Its dedication to this is shown by the regulator's pursuit in crafting the framework for weather index insurance with the help from the World Bank.

With regards to the practicability of parametric insurance in Zimbabwe, the interviewees also indicated that it was practical to adopt this type of insurance. To support this view, it was mentioned that mutual relationships which are between Zimbabwe and other nations most specifically China would make it possible. China may assist with investment and the installation of more advanced weather stations replacing the outdated ones across the country. Such initiatives will provide aid in the recording of weather data and making sure accurate

weather data is available. This laid the concrete foundation for adoption of index insurance contracts for weather related perils.

It was also pointed out that Zimbabwe and other African countries are vulnerable to natural disasters and making reference to this will create a market for parametric insurance but a lot of things need to be met for this type of insurance coverage.

The interviewees also pointed out that the response of the government towards natural disasters was poor and not effective. The government was also having challenges and failing to assist or support local companies in the underwriting of catastrophic risks. This was mainly due to the economic turmoil.

Last but not least, the respondents mentioned the challenges surrounding the successful adoption of parametric insurance products in Zimbabwe. The reasons include lack of capacity by local companies, lack of expertise and skills in this field of insurance and lack of support from the government. The interviewees pointed that it was possible for these challenges to be addressed and enhance to the effective adoption of parametric insurance.

4.9 Chapter Summary

This chapter presented and analyzed the data which was collected through questionnaires and interviews. The data was presented through the use of pie charts, tables and graphs. Some of the data collected was elucidated qualitatively. The researcher will make conclusions and recommendations basing on the research findings in the next chapter.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter summarizes and summarizes the complete study endeavor, as well as the conclusions taken from the research findings. It also includes practice recommendations as well as areas for additional research. The research intended to explore the adoption of parametric insurance in Zimbabwe.

5.2 Conclusions

The following conclusions were derived from the study's findings:

- Zimbabwe is one of the underdeveloped countries with low or no resources to finance natural calamities, which presents a huge opportunity for parametric insurance.
- In the Zimbabwean market, natural calamities are covered by crop insurance and property insurance. Crop coverage, on the other hand, remains constrained and limited due to the fact that just a few distinct crops are covered.
- In the Zimbabwean market, reinsurance companies use or resort to mandatory retention, special risk consortiums, and retrocession to manage catastrophic portfolios. The Insurance Council of Zimbabwe manages the special risk consortium, which is a pool where risks are transmitted.
- The government's support for catastrophic risk portfolio underwriting is still lacking. Insurance companies are not bolstered by the government in underwriting catastrophic risks and this has made it too risky for reinsurers to be participants in catastrophic risk contracts amid fears that this will bankrupt them.

- Index-based insurance contracts, often known as parametric insurance, are still a concept on paper. Some weather index products are still being introduced, which has built a solid foundation for parametric insurance, but these contracts still require significant improvements and investments.
- The government's reaction to natural catastrophes has been inadequate in terms of compensation, evacuation, and resettlement of displaced households. The current economic downturn was cited as a contributing factor in the weak catastrophe response.
- Well-developed weather infrastructure, government support, and strong financial capacity for reinsurers, knowledge and technical skills, and flexible regulatory approval and legislation that will allow more players to participate are all required success factors for the successful implementation of parametric insurance.
- In Zimbabwe, the most important factor for performing parametric insurance, which is the availability of automated weather stations and meteorological data, was met. There are currently more than 45 weather stations with trained meteorological professionals available, which can be supplemented by farmer-run stations.
- The government would have to put in a lot of effort to ensure that the other success conditions are realized.
- There is a lot of optimism in Zimbabwe that parametric insurance will be available, particularly for the most alternating calamities, such as droughts and floods. The majority of meteorological or weather stations are typically set up to record rainfall (rainfall index). Another source of optimism is the fact that parametric insurance has proven to be successful in managing disaster risks in other nations.

- In Zimbabwe, the adoption of parametric insurance is hampered by administrative constraints and a lack of capacity.

5.2 Recommendations

The following recommendations were made by the researcher and it was felt that if they a applied they will allow a successful implementation of parametric insurance in Zimbabwe

a) Creation of strategic partnerships

Insurance companies who are willing to take part in parametric insurance can create strategic partnerships with different organizations such as banks, NGOs, aggregators so as to get assistance with resources which will boost their capacity. It is necessary for companies combine efforts and work together in the development of parametric insurance products. For instance, when a parametric pilot project was launched in Malawi, a total of nine insurance companies worked together in conjunction with finance companies such as the Malawi Rural Finance Company and this was done so as to increase and boost capacity. Insurance companies can even work together with the Meteorological Services department in the country in order to make improvements on weather station and weather data. In Zimbabwe reinsurers, insurance companies and other organizations can work together and make it possible for the implementation of parametric insurance at a large scale.

a) Government support and incentives

In the Zimbabwean market, insurance companies on their own have got limited finances, constrained assets and do not have the capacity to shoulder catastrophic risks which are covered under parametric insurance. The government can support insurers by providing

financial incentives and regulatory support. This can be done by providing tax reliefs and subsidies for catastrophic risks for example companies who underwrite natural disasters specifically earthquakes are given tax deductions in Japan.

This will provide insurers with the motive to underwrite catastrophic risks as well as boosting their capacity to underwrite such risks. In addition the government can play a critical role in the development of parametric insurance products. It can embrace parametric insurance and become a leader on the pilot project as well as encouraging insurers and other institutions to embrace the pilot project. For example in Bangladesh, Malawi, Alabama and Uruguay the governments were in the front line when parametric weather index pilot projects were launched.

b) Catastrophic bonds

The use of catastrophic securitization through issuing of catastrophic bonds will probably boost capacity. In other instances, they are referred to as event linked bonds. Catastrophic bonds are mostly used to get additional protection for risks which have high severity and low frequency. Reinsurers can obtain crowd coverage and get the chance to underwrite catastrophic risks. The catastrophic bond works in relation to physical event parameters taking for instance wind speed. The Cat bond can be supported by local investors or international investors and the government or insurer can issue it. There is a use of the safe account where the money invested is placed in. if a physical event occurs and its intensity exceeds the predefined thresholds, money will be taken out to settle claims. If the event does not take place the money remains in the safe account (the bond will not pay) and the investors get repayment of the principal with high interests. An example to rely on is the Multicat of

Mexico. In Zimbabwe reinsurers can boost their capacity through the use of bonds and the government can also issue the bond.

c) Catastrophic Risk pooling mechanisms

Catastrophic risk pools require extensive coordination between participants in order for them to be effective. These involve pooling of risks and erecting or building a strong capital base. Risk pools can be supplemented by reinsurance and have better access to international markets which tends to provide financial support. The losses incurred are borne by the pool and the participants are protected from catastrophic perils. Risk pools have recently emerged regionally with international risk pooling such as Caribbean risk facility and the African Risk Capacity. In Zimbabwe it is possible to establish a catastrophic risk pool. The local insurance companies will participate as investors and the parametric cover can either be purchased by the government or other institutions and the public.

d) Establishing a clearing house or A data sharing center for index insurance

A clearing house is a platform where the information gathered (weather data) is shared and made available (Ogden, Bovarnick and Hoshijima, 2015). The data gathered is for collective use and be used to reduce the costs associated with risk assessments and tracking of indexes. Such information will incorporate information concerning the programs taken, their developments as well as challenges faced. It will act as a focal point or central source of information especially on parametric product designs and provide the best practices. Taking for example the Green Climate Fund.

e) Collateralized reinsurance

Soar (2014) ascertains that collateralized reinsurance is the type of reinsurance which is fully collateralized. Third party investors are the ones who insert the collateral. This mechanism is used to transfer risks from the insurance market to the capital markets. In most cases the collateral inserted by third party capital providers matches the contract limit of reinsurers. Reinsurance companies can boost capacity through collateral contracts, increase efficiency in the management of risk profiles as well as lowering underwriting costs. Catastrophic contracts such as parametric insurance may bankrupt reinsurance contracts but with collateralized reinsurance these contracts can be fully backed and hence reducing the chances and risk of bankruptcy.

f) Collaborating with Multilateral organisations and developed countries

It is essential to collaborate with multilateral organisations and other developed countries in order for Zimbabwe to meet some of the success factors of parametric insurance. Some developed countries such as Japan and China are assisting many countries in setting up index insurance. Support from these countries is very essential for parametric insurance to work. In addition multilateral organisations such as banks are also important and taking for instance the World Bank which helped Malawi in implementing its pilot weather index insurance. This will also help the country to minimize first phase costs which are associated with limited experience

g) **Special parametric cover for alternating hazards**

In Zimbabwe, the most alternating disasters are floods and drought. Arranging parametric insurance which provide cover for floods and drought will ensure compensation for losses that might incur as a result of these hazards. This will give a sense of security to the local people.

5.3 Suggestion for further research

The research focused on the practicability of parametric insurance in the Zimbabwean market as a tool in managing natural disasters. The researcher suggests that further research may be carried on parametric insurance as a complementary tool to traditional insurance policies.

5.4 Chapter summary

This chapter gave conclusions on the research findings on the practicability of parametric insurance in Zimbabwe. Recommendations were made and the area for further research was suggested.

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QUESTIONNAIRE

FELLOWSHIP OF THE INSURANCE INSTITUTE OF ZIMBABWE
IN CONJUCTION WITH NUST
DEPARTMENT OF INSURANCE & ACTUARIAL SCIENCE

Date…./…../2022

To whom it may concern

Dear Sir/Madam

REF: **Request for information on a research**

My name is Tatenda Nyamande (63-1535353v18). I am a student at the Insurance Institute of Zimbabwe studying towards a Fellowship of the Insurance Institute of Zimbabwe. The researcher is conducting a research and the research concentration is thus on "AN **INVESTIGATION ON THE PRACTICABILITY OF PARAMETRIC INSURANCE (INDEX INSURANCE) IN ZIMBABWE."** To this end I intend to collect data by use of the attached questionnaire. All the information provided by the respondents will be treated and handled with strict confidentiality. The findings of this research are for academic use only.

Your co-operation will be deeply appreciated

Yours sincerely

Tatenda Nyamande

0778 134 227 email, tnyamande@nicozdiamond.co.zw/tatendanyamande94@gmail.com

QUESTIONNAIRE FOR REINSURANCE COMPANIES IN ZIMBABWE

Instructions

Kindly provide answers on the spaces provided and kindly tick where appropriate. Note if the spaces provided are insufficient kindly use an additional paper. (N.B There is no correct or incorrect answer)

1. Gender?

Male ☐ Female ☐

2) Are natural disaster risks underwritten at your organization?

Yes	
No	

If Yes, what kind of perils are covered and under which products of insurance. However If it's a No, Kindly cite reasons?

……

……

…….

3) Do you know about Parametric Insurance?

Yes	

No	

4) What strategies do you employ in managing catastrophic portfolios?

……

……

5) Is your organization considering and planning to implement parametric or index insurance?

Yes	
No	

Briefly explain why

.....

.....

.....

……

……

6) Are you receiving any support or backing from the government towards underwriting catastrophic risks?

Yes	
No	

7) If your ANSWER is Yes on question 6, Rate the support?

High	
Moderate	
Low	

8) If the government is to take a lead on parametric or index insurance for natural disaster risks, would you participate in risk sharing?

Yes	
No	

9) If your answer is Yes for question 8 above, which catastrophic natural disaster risks would you prefer to accept?

Droughts	
Hail and Snow	
Flooding	

Specify Others…….

10) With regards to alternating natural disasters in Zimbabwe that is drought and flooding, the government in collaboration with its arms have responded in different ways. Can we safely say they have applied risk management principles?

Yes	

No	

11) Based on the scales below, what is your rating on the government's response to natural disasters which the country has been exposed to?

$\frac{1}{5}$	
$\frac{2}{5}$	
$\frac{3}{5}$	
$\frac{4}{5}$	
$\frac{5}{5}$	

12) In your own point of view is it practical to adopt parametric or index based insurance for natural hazards in Zimbabwe?

Yes	
No	

Briefly Explain why?

……
……

……
……

11) What are the necessary measures that should be put in place in order to successfully adopt parametric or index insurance against natural disasters?

……
……
……
……

Thank you.

Interview guide for reinsurance companies

1. Do you underwrite natural disaster risks?

2 Do you know about parametric insurance?

2. Have you even considered accepting parametric or index insurance for weather perils?

3. What do you employ in managing catastrophic portfolios?

4. Do you get any support or backing from the government towards catastrophic risks underwriting?

5. If the government is to take a lead on index insurance for natural hazard risks, would you participate?

6. With regards to alternating natural disasters in Zimbabwe that is drought and flooding, the government and its arms have responded in different ways. Can we safely say they have applied risk management principles?

7. On a scale of 1-5 what's your rating on the government's response to national disasters

8. Do you think it is practical to adopt parametric or index based insurance in Zimbabwe for natural disasters?

9. What do you think are the necessary measures that should be put in place in order to successfully adopt index insurance?

Interview guide for the regulator, Insurance and Pensions Commission (IPEC)

1. Are natural disaster risks being underwritten in Zimbabwe?

2. As a country do we have guides or standard rating tables for underwriting natural disaster risks?

3. Have you ever considered regulating index insurance?

4. In your own opinion is it practical to adopt weather index based insurance in Zimbabwe?

5. With regards to flooding and drought as alternating hazards in Zimbabwe, the government through its arms have responded in many ways. Can we say they have applied risk management principles?

6. On a scale of 1-5, what is your rating on the government's response to natural national disasters?

7. Does the government provide any support or backing to local insurers and reinsurers towards accepting catastrophic risks?

8. If the government is to take a lead on parametric weather index insurance for natural disaster risks, do you think local insurance companies will participate in risk sharing?

9. Do you agree that a special parametric or index cover alternating hazards that is floods and drought, is appropriate and can be taken up for Zimbabwe?

10. In your own opinion what are the necessary measures that should be put in place in order to successfully adopt parametric or index insurance for weather related perils?