PRICE AND WEATHER RISK MANAGEMENT PRACTICES IN THE SUGAR INDUSTRY IN KENYA

BY

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DECLARATION

This research project is my own original work and has not been presented for a degree award in any other university.

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D61/61263/2011

This project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

To my family, my dear wife Dorice Aol, children Winnie, Reagan, Esther and Bob who gave me all their support and encouragement and had to get used to my absence from home during the entire period of the study. Thank you a lot, you are the best.

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ABSTRACT

The study sought to find out if price and weather risks management instruments are applied in the sugar industry sub sector in Kenya and if so, whether the instruments are effective. A guided questionnaire was used and face to face interview was also conducted. In some cases, telephone interview was administered to gather primary data. A response of 100% for primary data was achieved and the data was analyzed using descriptive statistics.

The theory of futures markets, McKinnon (1967) portends that, instruments known as derivatives can be used to manage risks associated with commodity price fluctuations and adverse weather consequences. Indeed these instruments are used in other parts of the world such as America, Spain, and Canada with good degree of success. The study however, found that in Kenya and particularly in the sugar industry derivatives are not applied yet.

Sugar and cane prices fluctuate so much that the farmers and millers sometimes incur big losses in the industry. The finding of the study was that even though derivatives are not used, alternative methods are available to farmers although they are not as effective. Weather Index Insurance (WII) which has been used in developed and some developing countries to manage the risks associated with adverse weather is also not applied in the industry.

According to the findings of the study weather risks management needs the involvement of the government for it to work effectively since there is huge financial cost which the farmers are unable to bear. Insurance companies, the government and the farmers need to team together to make weather risks management tools such as WII work. Insurance companies currently offer fire insurance policies to cane farmers but this has not been embraced well due to high cost associated with such premiums.

It was found out that sugar cane farmers have resorted to ineffective alternative ways to reduce price and weather related risks. The researcher recommends that the government through the Ministry of Agriculture, Livestock and Fisheries should incorporate some of the risks management instruments like WII and irrigation in their strategic policy formulation to assist the sugarcane farmers to address the perennial problems associated with drought and floods. Left to the farmers alone, the industry will be unattractive employer in the country as growth will not be guaranteed.

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Risk management is the identification, assessment and prioritization of risks likely to occur followed by coordinated application of activities to minimize, monitor and control the probability of such unfortunate events. Risk itself is the effect of uncertainty on objectives, whether positive or negative. It can come from natural causes and disasters as well as events of uncertain or unpredictable root cause (ISO 31000).

The strategies to manage threats (uncertainties with negative consequences) include transferring the threat to another party (derivative markets), avoiding the threat, reducing the negative effect or probability of the threat, or even accepting some or all of the potential or actual consequences of a particular threat (ISO 31000). In agriculture for example, putting in place activities and actions to mitigate the negative effects of commodity price variations and adverse weather effects is risk management. The control of such adverse effects usually comes with the benefit of improved production as well as increased income to farmers.

The theories that explain price determination include Keynesian, monetarists and new classical theories. Keynesian recommends that policy should respond to current or expected economic conditions. According to Keynesian, by accommodating the adverse supply shocks, fluctuations in real output can be reduced. Monetarists and classical theorists however, offer the view that by adhering to simple policy rules, uncertainty will be reduced and economic performance improved. Monetarists and classical theorists contend that the economy will operate most efficiently if left on its own under stable, predictable policy rules (Kahn, 1984).

1.1.1 Price Risk Management Instruments

One way the producers manage price variability is to enter into pre-harvest agreements that set a specific price for future delivery. These arrangements allow producers to lock certain prices thereby reducing risks but also foregoing the possibility of benefiting from positive price deviations (World Bank 2005). These Price risk management instruments also known as derivatives include forward contracts, futures and options.They are referred to as derivatives since they derive their values or usefulness from underlying assets such as agricultural commodity. A forward for example sets today terms at which to buy or sell an asset or commodity at a specific time in future. It obligates the seller to sell and the buyer to buy (McDonald, 2006).

Massell (1969) advanced price stabilization theory by setting Marketing Boards and Stabilization Funds. It had some limitations and its use started fizzling out in the 1980s. However, it was the theory of futures markets (McKinnon, 1967) that set the tools known as derivatives that are widely used today. What the instruments do is to provide a price protection to the producer until the crop or the commodity is sold. This way the producer or seller hedges against the risk associated with unfavorable price changes. Other instruments like options give the producer the right but not the obligation to sell at a predetermined price and date. In this alternative, the producer is not only assured of a minimum price but could also benefit from higher prices at the expiration of the contract (McDonald, 2006).

1.1.2 Weather Risk Management Instruments

The ability of the farmers to mitigate the impact of unfavorable weather conditions is limited (Hess, Richter, &Stoppa, 2002). Weather risk management instruments are applied to protect the producers of agricultural products against the effects of adverse weather. Too much or too little rain for example, is normally not favorable for agricultural produce, hence putting the farmers at a risk of loss of crop or low yield thereby leading to poor income.The instruments include weather index insurance which works as follows; over a period of time the historical weather statistics of a region is mapped to determine scientifically the crop yields per acreage. An estimate is then made for a particular farmer’s potential harvest in the region.

Insurance cover with the support (subsidy) of the government is then provided to the farmers in the mapped area against the risk of crop failure due to adverse weather. If the crops fail, then farmers are compensated using established 'factor' without the need to go to the fields to assess the extent of the loss (Bryla, Dana, Hess, Varangis, Tiffen, Richter and Stoppa, 2011).

Ordinary insurance covers have also been used as weather risk management instruments. However, in this case, the farmer individually takes an insurance policy on own initiative to cover against the risks associated with weather. Should the risk covered occur, assessment of the extent of the loss is done in the fields and compensation given according to what insurers assess. Different farmers may be compensated differently depending on how their losses are assessed!
Other weather risk management tools include diversification to other agricultural practices such as keeping livestock, and adopting low-risk and low-yield crop to ensure a minimum income. This approach however, goes against the spirit of improved yields and production and may not be sustainable in the long run (Bryla et al 2011).

1.1.3 Sugar Industry in Kenya

Agriculture and forestry combined is the leader in contributing above 20% to Gross Domestic Product (GDP) of Kenya yearly for more than five years since 2008. However, Agriculture sector has shown a very low growth year on year and in 2008, the growth was negative -4.1%, in 2009 it was negative -2.6, in 2010 it was 6.4% and in 2011 it grew by only 1.5% (Kenya National Bureau of Statistics 2012).
The sugar sub-sector is a source of livelihood for about 5 million Kenyans representing about 16% of the entire Kenyan population. The national annual consumption of sugar is about 700,000 MT against production that stands at about 500,000 MT. The industry is labor intensive providing direct and regular employment for 35,000 workers. Small scale farmers dominate the sub-sector by producing 88% of a total area of 108,793 hectares under cane. The sector as part of Agriculture contributes a significant 7% or Kshs. 9.1 billion to GDP (Institute of Economic Affairs, August 2005). According to Cane Census Survey (2012-2014) conducted by Kenya Research Foundation, the area under cane had increased to 207, 483 hectares by end of 2012.
It is important to understand how the two main risks suffered by farmers can be managed to facilitate better production yield and to make the sub-sector a reliable income earner.

Sugarcane as a crop was introduced in Kenya in 1902. The first sugar factory was set up in Miwani in Kisumu County in 1922, then in Ramisi in Kwale County in 1927, Muhoroni Sugar Company Limited in 1966 and Chemelil Sugar Company Limited in 1968 both in Nyando Sugar Belt, Kisumu County. The government then embarked on expansion of production of sugar and put up Mumias Sugar Company Limited in 1973, Nzoia Sugar Company Limited in 1978 and South Nyanza Sugar Company Limited in Migori County in 1979 at Awendo (Odek, Kegode, & Ochola 2003).

Private owned sugar companies have also come up and they include; West Kenya Sugar Company Limited in 1982, KIBOS started operation in 2008, Butali Sugar Mills started operation in January, 2011 and Transmara and Sukari Industry Limited started in December, 2011 (KSB-Year Book of Statistics, 2011).

Despite the fact that the sub-sector has the potential to contribute immensely to the national economic growth, it has been faced with a lot of problems ranging from trade liberalization, weak or absence of policy governing the industry to weather risks generally affecting agricultural activities. State run sugar factories have not fared well for many years. Ramisi has since closed altogether while others like Muhoroni Sugar Company Limited and Miwani Sugar Company Limited have been put under receivership. Farmers too have suffered the consequences of adverse weather conditions, erratic price fluctuations, and inability to access funds to invest in farming. In many parts of the country, their living standard has not improved at all. Consequently, they have opted to diversify to other agricultural activities such as horticulture, animal rearing and even to some traditional agricultural practices just to try to make additional income.

Sugar Industry is established in 127 countries worldwide with the main producers being Brazil, Australia, Cuba and Thailand. The biggest importer of sugar is Russia (Odek, Kegode & Ochola, 2003). The commodity sugar is largely produced for local consumption, so that only about 30 per cent is traded internationally. Out of 501,473 tons of sugar made in Kenya in 2011, only 16,716 tons (3.3%) was exported. However, the import in the same year was much higher at 139,076 tons (KSB-Yearbook of Sugar Statistics 2011).

Various by-products derived from sugarcane include sugar crystals, sugar syrup, molasses, filter scums and bagasse used for running the boilers to generate power and for making pulp. The industry therefore can be a main source of economic development due to its diverse range of products. In general, sugarcane can be converted into fifty one generation derivatives for commercial operations which in turn can be used to produce over one hundred second generation derivatives (The CGD Bills Digest / June 2005).

The price and weather risks in agriculture normally lead to poor yield per hectare and general crop failure. The consequence to the farmer is disastrous since crop failure implies loss of income for a long period of time (on average one year) before the next harvest. For a sugarcane farmer, while other countries using irrigation enjoy cane yield of up to 150 tons per hectare, in Kenya where there is over reliance on rain-fed farming, the yield is less than 70 tons. It averaged 58.78 tons per hectare in 2011 (KSB –Yearbook, 2011).

Price of cane and sugar can fluctuate by 73% and sometimes up to 120% of average prices in any particular year. In the year 2011, cane prices ranged from Kshs. 2,600 per ton to Kshs, 4,500 per ton. Ex-Factory sugar prices on the other hand, varied from Kshs. 73,660 per ton to Kshs. 156,160 per ton in the same year (KSB-Yearbook, 2011). These risks among others negatively influence the farmers' profitability, standard of living, ability to build capital, ability to access credit from lenders and even the growth of the industry.

Sugar price uncertainties and volatility have caused bankruptcy to some companies. Farmers especially smallholders have fallen into never ending poverty situation and consumers also subjected to spiraling sugar prices. Weather risks too, have caused crop failures, poor harvest, dismal income returns and have hindered banks from lending to farmers as they worry about high rate of default. To be able to improve sugarcane farming and turn it into a profitable and sustainable industry, these risks need to be managed. In some countries especially developed countries, the risks have been mitigated thereby making some formerly un-creditworthy producers/ farmers eligible for lending. Developing countries in Africa like Morocco and Tanzania have dealt with the price and yield risk with some degree of success and is worth learning from (Bryla, Dana, Hess and Varangis, 2001).

1.2 Statement of the problem

Price and weather risks can present problems of serious consequences in the sugar industry if little is done to manage the risks. Tanzania for example is working closely with the World Bank to utilize the price risk management instruments to hedge coffee price fluctuations (which made it difficult for farmers to optimize their production). Morocco government has also been involved in weather risks management instruments with cereal products. Both have realized benefits but a huge government financial involvement is required in order to succeed (Bryla et al., 2011).

In developed economies like USA and Spain risk management instruments have been used for many years. Market price instruments like futures and options are traded in the exchanges freely. Weather Index Insurance (WII) is undertaken with heavy support of the governments. The consequence is that the risks are reduced to a great extent and the farmers have benefited (World Bank, 2005).

Local studies have been done in Kenya in this area: a study by Zhou, Owuor & Mutai (2012) revealed that weather index insurance among other activities undertaken by Syngenta Foundation in partnership with UAP Insurance and International Finance Corporation (IFC) has had a positive impact on the livelihood of Laikipia maize farmers. The project popularly referred to as Kilimo Salama has been embraced successfully by farmers in Laikipia and has now expanded to Rwanda. The study did not however deal with the price and weather risks directly but instead dwelt on the impact of the foundation's activities on the livelihood of farmers. Githaiga (2010) looked at the challenges facing the performance of agriculture insurance in Kenya and concluded that agriculture insurance awareness is low and that it is expensive to farmers but has the potential to perform well if all the stakeholders work towards its success. He however, did not look at the commodity price risks management in agriculture sector.

In ''The Challenges and Way Forward for the Sugar Sub-sector in Kenya'' study by Odek, Kegode and Ochola (2003) it was identified that sugar price instability is one of the main challenges and the study proposed safeguards to be put in place to save the industry from collapse. The study does not however, cover the weather risks concerns.

Price and weather risks management practices as applied in sugar industry in Kenya have been partially studied as already highlighted. This study intends to find out to what extent have these instruments been used in the industry and how successful have they been?

1.3 Objective of the study

The study seeks to find out if price and weather risks management instruments are used in the sugar industry in Kenya.

1.4 Value of the study

Not a lot of study has been done in this country in price and weather risks management in sugar industry. The study will enable in-depth understanding of how the two identified risks can cripple the development of the industry in Kenya if they are ignored. The study therefore intends to add to what is already available as challenges bedeviling the industry.The study could help to incorporate the risks instruments in policy formulation and practice in the management of the sugar industry.

The fact that prices and weather risks can be mitigated makes a case for farmers, particularly smallholders to be able to access funds from the financiers. The risks can be shared and even diversified away if risk management instruments are applied to the industry. This is likely to make capital building possible to invest in the industry. There could be positive result of higher yields in the sector and predictable stable incomes. In the long run, the industry may turn profitable to all stakeholders including farmers, millers, traders and finallyfinanciers who may stop viewing the act of lending to farmers a risky business. Different approaches have been applied by different countries and the literature review that follows in the next chapter has captured a few of the works already done in Agriculture sector in general.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter, the study intends to cover the literature review in four sections. The first section will show how important the sugar sub-sector is in the economy and how the two identified risks could pose a serious threat to the industry. In the second section some of the theories in risk management are covered with specific reference to prices and weather risks in Agriculture sector and sugar sub-sector in particular. In the third section of this chapter, the specific risk management instruments will be explained, how they work and how they are applied in real situations. The last section of the chapter will be the summary from the literature review.

2.2 Theories Supporting the Study

To deal with commodity price fluctuations, two theories (models) are fronted. The first looked at stabilizing prices by setting up Marketing Boards and Stabilization funds. This involved the use of buffer stocks or managed trade with the intention of bringing order. (Massell, 1969) model argued that stabilization enables producers and consumers gain or lose depending on whether instability lies on supply or demand side. However, in both cases, gainers could afford to over-compensate the losers, so there are net benefits from price stabilization (Akiyama, Baffes, Larson and Varangis, 2001). This theory was criticized by Newbery and Stiglitz (1981) that it exaggerated the benefits of stabilization and that implementing stabilization raises many problems to be overcome by program administrators.

On the other hand, McKinnon (1967) explored the use of futures markets as an alternative to buffer stocks. Later Gemmill (1985) argued that futures markets for cocoa, coffee and sugar provide an attractive mechanism for hedging export earnings risks and they were cheaper than buffer stock operations. The risk management tools available to mitigate risk for farmers include; futures and options, and Index-Based Yield insurance.

2.3 Price and Weather Risk Management Instruments

2.3.1 Market price based risk management instruments

Market price risk management instruments, that is, forward contracts, futures and options derive their values or usefulness from underlying assets such as agricultural commodity. They are merely agreements between two people who agree on what price to buy/sell a commodity or asset at a future date (McDonald, 2006).

In the case of sugar, here is how a forward contract may work. A company based in Europe may enter into an agreement with a sugar producer in Kenya as follows: the Kenyan miller to produce 30,000 tons of sugar in 2014 and the two companies set a priceof say, $ 500 per ton at which to buy/sell at a future date, say in October 2014. The seller who is the Kenyan producer will be obligated to sell to the European company at that agreed price whether or not the price is above that agreed in the contract at expiration date. The buyer too, the European company, is obligated to buy at the same agreed price irrespective of whether the prices will be lower than agreed in the contract. This way the risks of wild price fluctuations is mitigated or hedged and the sugar producer and by extension the cane farmer is guaranteed a steadier or predictable income. This arrangement as can be seen, allows producers to lock in a certain price, thus reducing risk but also foregoing a possibility of benefitting from positive price deviations. It is possible for either the buyer or the seller to make losses with a forward contract. But other alternatives known as options can cushion both parties against losses. They represent a price guarantee that allows producers to benefit from floor prices and also the possibility of taking advantage of positive price changes. A buyer may choose to go instead for a call option contract where he has the right but not the obligation to buy (McDonald 2006).

For example, the European company in the example above may enter into a call option contract that fixes the sugar price per ton at $500 in October 2014. If the sugar price is $550 by expiration date, he has the right to still buy at $ 500. But if price is lower at the expiration date to say $ 450 per ton, he may choose not to buy since he can buy cheaper sugar elsewhere. In this type of arrangement, the buyer is insulated against the risk of making a loss. Normally at the time the buyer and the seller agree to the contract, the buyer must pay the seller an initial price also known as premium. This initial payment compensates the seller for being at a disadvantage at expiration (McDonald, 2006).

Available to the seller is a put option which gives him the right but not obligation to sell to the buyer. In the example above, if the Kenyan sugar producer has agreed to sell to the European company at $ 500 per ton in October, 2014, and has the right but not obligation to sell, then he has purchased a put option. If at expiration date the sugar price is $550, the seller will not sell but will walk away since he can sell elsewhere for a better price. However, if the price is $ 450, the seller will sell for $500 per ton. Therefore a put option too must have a premium paid by the buyer at the time the option is purchased to compensate the seller at expiration date (such an option is called European options). There are options which need not be exercised at their expiration date. American options, which can be exercised at any time on or before their expiration dates, have commencement dates that coincide with their dates of initial issuance (Grinblatt and Titman, 2002).

While market based tools (forwards, futures and options) that insulate producers from thenegative effects of short term price volatility are widely used in high-income countries, the vast majority of agricultural producers in developing countries are, in general, unable to access these markets (The World Bank, 2001). In the absence of market based tools for hedging price risks, farmers try to cope with the problem by self-insuring through asset accumulation, savings and access to credit; income diversification and informal insurance arrangements. Informal insurance arrangements at the local community level often break down in the face of large systemic risks such as the collapse of commodity prices.

The risk still remains to farmers in developing countries as asset accumulation and saving is not enough to see them through a protracted serious crisis and diversification to other activities is made difficult by the farmers' lack of skills, information and capital to do something else (Bryla et al. 2011).

According to Bryla et al. (2011) using the derivatives (market based price instruments) helps to reduce the commodity price risks and therefore eliminates an important reason for falling commodity prices, non-repayment of loans, and could substantially help to reduce the agricultural financial risks. The use of market based price risk management instruments to mitigate the price risk would provide farmers with new alternatives and allow them a greater certainty in planning their farm activities and possibly provide greater access to credit.

2.3.2 Weather Based Risk Management Instruments

The impact of weather events like droughts, floods, frosts and hurricanes presents farmers with more difficult challenge of agricultural production. The ability of the farmers to mitigate the impact of unfavorable weather conditions is limited (Hess, Richter, &Stoppa, 2002). Weather risks typically shock entire regions at once. If one farmer is suffering from some sort of weather problem it is likely that all his neighbors are also. This makes it very difficult to set up local insurance schemes that have sufficient diversity to deal with such risks. This in turn bankrupts and makes inefficient ''risk pools'' and other local insurance schemes in the time of weather crisis in a given area because all farmers must be paid at once (Skees, 2003).

Weather risk has been one of the justifications for supporting state owned agricultural banks to provide lending to farmers. Some developed and developing countries have adopted crop insurance programs to deal with yield variations identifying crop insurance as a way to protect agricultural credit. In many cases banks have linked crop insurance policies to the farmers' credit requests. A few developing countries have tried to link agricultural credit to some form of yield insurance, usually traditional crop insurance. However, traditional crop insurance has several problems including moral hazard, adverse selection and high administrative costs (Hazell, 1992).

Traditional crop insurance has encountered many problems including high costs and limited coverage. As a result, governments and private companies are looking into new approaches for linking credit to some form of output or weather insurance (Skees, Hazell& Miranda, 1999).

2.3.3 How does Weather-Based Index Insurance Work?

Weather-based insurance relies on objective observations of specific weather events that are outside the control of the farmers or insurance companies. They do not require individual contracts and on-field inspections and loss adjustments. They are also known as weather-based index insurance and are purely for risk management tools rather than traditional insurance and are less costly to administer.It compares a measurable, objective, correlated risk such as rainfall, temperature, wind-speed, among others to yields. For example, in the case of rainfall as correlated risk, historical data gathered from regional weather stations is used to determine the mean rainfall for a given period in the farmer's area. Once the appropriate period has been selected, the issue becomes structuring the rainfall index (Bryla,Varangis & Tiffen, 2003).

A weather (rainfall) ''index'' is designed to weight the more important periods for rainfall in the crop cycle more heavily than those periods where rainfall is not as important in production. Hence it is useful to develop a weighting system that allows to differentiate the importance of rainfall in different growth periods and to shape the model so as to take into account the fact that excess rain may be wasted without contributing to plant growth. The final value of the index (the value which, when compared with the threshold, indicates if the insured should be granted an indemnity or not) is calculated by summing the values obtained by multiplying rainfall levels in each period by the specific weight assigned to the period (Hess, Ritcher & Stoppa, 2002).

Index insurance is a simplified form of insurance in which indemnity payments are based on values obtained from an index that serves as a proxy for losses rather than upon assessed losses of each individual policyholder. The sum insured is normally based on production cost on an agreed value basis (fixed in the policy in advance), and payouts are made based on a pre-established scale set out in the insurance policy (World Bank, 2011).

Weather index insurance (WII) application for agriculture emerged from the belief that traditional insurance products were not viable for developing countries because of limited commercialization occasioned by small scale land holdings of majority of farmers. For the index to be a sound proxy of the loss, it has to be based on an objective measure (such as rainfall or temperature) that exhibits a strong correlation with the variable of interest (like crop yield).

Further, in developing countries, there are available ways in which the farmers can also deal with weather risks including self-insurance, diversification and adoption of low risk-low return production practices and sometimes undertake additional risk management practices such as irrigation and conservation tillage to protect soil and add moisture.

2.3.4 How the Instruments are applied in Agriculture Sector

The concept of weather-based index insurance is explained by the following example of how it works in USA. Multiple-peril yield and revenue insurance products are offered through Federal Crop Insurance Program (FCIP) which is a public/private partnership between the federal government and various private-sector insurance companies. Private insurance companies that sell federal crop insurance policies may not fail to sell policies to eligible farmer regardless of the past historical loss.Policies are available for over 100 commodities but in 2004 four crops i.e. corn, soybeans, cotton and wheat accounted for 79% or $ 4 billion in total premiums. It is estimated that about 72% of national crop acreage is insured under FCIP. About 73% of total premiums are for revenue policies and 25% are for yield insurance policies. Yield insurance offers are based on a rolling 4-10 years average yield known as Actual Production History (APH) yield. The federal government provides the farmers with base catastrophic yield insurance policy, free of any premium costs. Farmers may then choose to purchase, at federally subsidized prices, additional insurance coverage above the catastrophic level (World Bank, 2005).

The federal government also provides reinsurance mechanism that allows the insurance companies to determine (within certain bounds) which policies they will retain and which they will cede to the government. This arrangement is referred to as Standard Reinsurance Agreements (SRA).

It is interesting to note that in 2004, the federal government subsidized up to 59% of premiums across all FCIP products and up to 100% of premiums of catastrophic policies (CAT). Further, the federal government reimburses administrative and operating expenses for the private insurance companies that sell and service FCIP policies. This reimbursement is approximately 22% of total premiums. By 2004, the federal government paid on average approximately 70% of the total cost of FCIP. Farmer-paid premiums accounted for only 30% of the total costs. The premium subsidy paid by the federal government has been rising steadily over the years. There is still pressure to pass legislation to increase federal government subsidy (World Bank 2005).

In Spain, another developed country, the insurance system is structured around an established public/private partnership. On the public side, National Agricultural Insurance Agency (ENESA) coordinates, manages and subsidizes resources for insurance premiums and Insurance Compensation Agency (*Consorcio de Compensacion de Seguro),* together with private reinsurers provides reinsurance for agricultural insurance markets. Local governments are only involved to the extent that they are allowed to augment premium subsidies offered at the national level. On the private side, the insurance contracts are sold by Agroseguro, a coinsurance pool of companies that aggregates all insurance companies active in agriculture. Farmers, Insurers and Institutional representatives are all part of a general commission hosted by ENESA that functions as the managing Board of Spanish agricultural insurance system (World Bank, 2005).

In the case of Spain, just like in the USA, the insurance policies offered cover multiple perils in a combined program. Policies are available for crops and livestock among others, with the risks pooled across the country by Agroseguro. But unlike the USA situation, farmer associations are more involved in implementation and development of agricultural insurance. Government has reserves to cover extreme losses and as a final resort, the government treasury is used to cover losses that may occur beyond the reserves. Total premiums for agricultural insurance policies purchased was around US $550 million in 2003, of which approximately US $ 225 million was provided for by the government. Spanish producers are not eligible for disaster payments for perils for which insurance is offered. For non-covered perils, ad hoc disaster payments are available, but only if the producer had already purchased agricultural insurance for covered perils (World Bank, 2005).

In developing countries, Weather Index Insurance has been piloted in Morocco. The International Finance Corporation (CNCA) and the Moroccan mutual agricultural insurance company (MAMDA) jointly implemented an index based weather risk program. The ultimate intention was to determine if weather insurance would be used to explore the correlation between rainfall and cereal revenue.

Production yield and rainfall data from National Meteorological Society was collected and rain indexes constructed accordingly. It was discovered that the correlation between rainfall and cereal revenue was sufficiently strong in 17 provinces (World Bank, 2001).

Put in perspective, indemnity payment under this insurance arrangement was worked as follows; The appropriate yield (either average area yield or individual farm yield) is multiplied by the price (set at 130 MAD/quintal for barley, 200 MAD/quintal for soft wheat, 220 MAD/quintal for hard wheat) to determine the farmer's 'actual income'. This 'actual income' in subtracted from the insured income level to determine the amount of indemnity payment.

Insured Level – (Unit price * yield) = Indemnification

Example: (2,000 MAD/ha insured) – (200 MAD/quintal * 6 quintals /ha [farmer's actual yield used for Level 2 insurance] = 800 MAD/ha indemnification.

Note: 1 quintal = 100 kilograms

Source: World Bank, 2001

Moroccan government has incurred substantial fiscal cost in its support for CNCA and agricultural lending in addition to costs incurred for general drought relief. Given the significant costs of providing drought relief to farmers and supporting CNCA's financial viability, the Moroccan government has expressed strong interest in finding cost-effective ways to aid farmers in managing their drought risks and improving their ability to repay agricultural loans consistently (Bryla, Varangis & Tiffen, 2003).

According to World Bank (2004), Index-based approach has many advantages over the traditional crop insurance. It has timely and guaranteed payout in time of need. It has low administrative costs since insurers do not need to undertake field evaluation of losses. Thirdly, there is absence of moral hazards because payments are linked to an objective index trigger, measured at an official weather station. Lastly, it has standardized and transparent contract structure, with sufficient reinsurance capacity in international markets.

Its main limitations include the requirement that farmers be situated within a certain radius to weather station with reliable communication and good historical data. There is also the potential of a mismatch between payouts and the actual losses due to the fact that the contracts are based on an index rather than actual losses to the farmers.

2.4 Summary from Literature Review

Price and weather risks management instruments have been applied in many developed countries with varying degree of success. In those countries, price based instruments are well structured and are traded in exchanges. Options and futures are readily available, and are used to mitigate price risks associated with agricultural activities.

Weather based risk management tools have also been used in the developed countries including America, Canada and Spain just to mention a few. It should however, be noted that weather based risk tools require heavy financial support from the government to manage since the risks are covariant and affect a big area at ago.

In developing countries, the use of derivatives to mitigate the effects of price based risks may be limited in use. It is not certain whetheragribusiness derivatives are fully operational in Kenya. The weather based risks are more worrying for agricultural producers due to their widespread impact when they do occur. Ordinary insurance policies are not only too expensive especially for small scale farmers but are not adequate covers to deal with severe weather situations like, floods and drought. Some developing countries like Morocco have tried weather index insurance on cereals and are still monitoring the viability of such undertakings.

It is of interest to explore the extent of the use of these instruments in Agriculture and specifically the sugar sub-sector in Kenya. Is the government supporting their application particularly the weather based tools which if not supported have a devastating impact on production yield and ability to access financing to inject in the sector for sustainable activity growth?

Price and weather risks instruments combined could provide comprehensive income insurance for producers of sugarcane and sugar. The effect of managing these risks would also provide banks and financial institutions the opportunity to take on far less risk when lending to farmers. This would improve the ability of financial institutions to offer their service to agricultural producers. However, for the success of the two innovations, the government must give its full support in liaison with private insurance companies.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology and procedure that was used to obtain the research data. It outlines the research design, that is, the blueprint for fulfilling objectives and answering questions, the target population, the sample size, data collection instruments, data collection procedure and finally the data analysis and presentation (Cooper & Schindler, 2008).

3.2 Research Design

Since the study sought to find out to what extent price and weather risks management practices are applied in sugar industry, a descriptive survey method was carried out. The study used mainly questionnaires and interviews. In addition, personal interviews with the selected managers of various sugar companies and farmers in all sampled sugarcane regions were conducted. Telephone interviews with some selected influential personalities in the industry were also conducted.

See **appendix 1**for the timetable used for conducting the research.

3.3 Target Population

There are eleven operating sugar companies in the country with full activities of cane growing, milling and selling the final products and by-products. The research covered six sugar companies, that is, (54.5%) of all operating sugar companies. It should be noted that sugarcane companies are also farmers whose farms are called nucleus estate and represent about 10% of total sugarcane supplied to the factories. In terms of area under cane, the sample tested represents 7.5%, that is, 15,650 hectares of the total 207,483 hectares under cane as at the end of 2012 according to Cane Census Survey (2012-2014).

3.4 Sample Design

Six sugar companies with farms were selected at random to cover all the sugarcane belts. A further 3 large scale farmers (over 500 acres of land under cane) also selected at random spread in the geographical area of the six companies were interviewed. The sample size was nine in total.

Since prices and weather risks impact all the farmers in a big geographical area, it was deemed that covering the institutions and large scale farmers was adequate representation of the entire population.

3.5 Data Collection

Both primary and secondary data was collected. The study used one set of simple structured closed ended questionnaires and administered them to all targeted respondents by physical drop and pick of the questionnaires. Face to face interviews as well as telephone contacts were also administered. Questionnaire was preferred due to ease to administer, analyze and time saving advantage that it comes with.

Secondary data from the journals, the web, and relevant books were also collected and form part of key data collected for in depth analysis for final report of the research. Secondary data is useful because they have had at least one level of interpretation inserted between the event and its recording (Cooper & Schindler, 2008).

The data collection procedure included the preparation of an introduction letter (authorization letter) from the university to introduce the researcher to would be respondents. It indicated where and the dates when the research was to be conducted, who the researcher was, and a confirmation and assurance that the research information was to be treated as confidential and was to be used for academic purpose only.

3.6 Data Analysis

The data collected for the purpose of the study was edited to eliminate errors and omissions, thereafter adopted for completeness and accuracy before being used. Exploratory Data Analysis (EDA) was used to analyze data collected. The responses from the questionnaires were analyzed using tables as found desirable and applicable. Lastly, interpretation of the data was made as supported by the analyzed data before interpreting and writing the final findings.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter provides the results of the study which was to find if price and weather risk management practices are applied in Sugar Industry in Kenya. The results are covered in the next four sections namely; the response rate, characteristics of the respondents, the results of the finding and lastly the discussion.

4.2 Response Rate

The researcher collected primary data from six sugar millers out of eleven that are in operation. All the targeted millers / farmers were contacted and they all responded enabling achievement of a response rate of 100%. The total land under cane as at December, 2012 was 207,483 hectares according to Cane Census Survey (2012-2014). The sample size covered 15,650 hectares which is 7.5% of total area under cane in Kenya. The data has been edited and analyzed in table format so as to understand and interpret the information.

4.3 Characteristics of Respondents

In the case of sugar millers cum farmers, the persons contacted were either Agriculture Managers or Finance Managers or both. These two officials are heads of departments in the institutions sampled. In the other three large scale farmers, two respondents were Managing Directors and one was the Farm Manager. Face to face interviews and telephone interviews were administered.

4.4 Research Findings

The findings from the research have been presented in table format. Firstly, the entire sample has been summarized in accordance with whether they are institutional factory or individual large scale farmers. The same table indicates the area of land sampled compared with the total land under cane in the country. The following five tables depict the analysis and interpretation of the data collected.

Table 1: Total Sample interviewed

No.	Interviewee	Miller / Farmer	Area under cane (Hectares)
1	Muhoroni Sugar Co. Ltd	Miller cum farmer	3,000*1
2	Chemelil Sugar Co.Ltd	Miller cum farmer	1,600
3	Mumias Sugar Co. Ltd	Miller cum farmer	3,500
4	Nzoia Sugar Co. Ltd	Miller cum farmer	3,600
5	South Nyanza Sugar Co.Ltd	Miller cum farmer	2,300
6	Transmara Sugar Co.Ltd	Miller cum farmer	300
7	Shamji Harji & Bros	Farmer	330
8	Pandhal Harji Singh & Sons Ltd	Farmer	708
9	Mazao Yetu Ltd	Farmer	312
	TOTAL		**15,650**
	Total area under cane (Industry)		**207,483**
	Percentage under cane covered by study		**7.5%**

*1 area under cane includes 1,400 Miwani's nucleus.

Most of the farms supplying the millers with cane commonly referred to as out-growers comprise of largely small scale holders averaging about 2 acres each and form more than 90% of sugarcane farms. The cane price paid in the industry is based on a 'simplified cane pricing formula' provided by the regulating body, Kenya Sugar Board. The formula is pegged on the price of sugar as provided below;

Cane price per ton = Price of sugar per ton (net of taxes) *0.1*50%

Where, Price of sugar per ton (net of taxes) is the gross price / 1.2064 (i.e. VAT 16% and SDL 4%)

0.1 is factory efficiency factor i.e. 10 tons of cane : 1 ton of sugar

50% is the share of the farmer in sugar price.

This simplified formula compares well with the cane pricing formula in the Sugar Act 2001 given here below which is not applied yet due to some conditions not having been fulfilled according to the Act.

$$\text{Price of Sugarcane} = \frac{\text{Pol\% cane} * \text{KR} * \text{Farmer's share} * \text{monthly average net price of sugar}}{(1+E\%)}$$

Where KR is Expected mill Extraction * Expected Boiling House recovery and E% is Extraneous matter % in cane i.e. 3%

The implication of the cane pricing formula is that the farmers normally take the cane price as given and have no means of negotiating it.

4.4.1 Awareness of Price and Weather Risk Instruments

Of the interviewees asked whether they had heard of price and weather risks instruments, 77.7% of the respondents answered to the negative. Only 22.3% knew the instruments existed. The table below captures the responses.

Table 2: Knowledge of either price or weather risk management instruments

	Frequency	**Percent**
Have heard of the instruments	2	22.3%
Have not heard of them	7	77.7%
Total	**9**	**100%**

Even the respondents who replied to having heard the price and weather risk instruments confirmed that they knew it was applied in developed countries but not in Kenya. It was found that the instruments are not used in the sugar industry in Kenya yet.

4.4.2 Management of Price Risks

When the respondents were asked whether cane was still their preferred cash crop despite the challenges, they all confirmed it was. The table below captures the responses.

Table 3: Would put more land under cane farming despite the price and weather risks

	Frequency	**Percent**
Would put more land under cane	9	100%
Would not put more land under cane	0	0%
Total	**9**	**100%**

All the respondents indicated that if they had more land, they would still put it under cane farming as opposed to other activities. The reasons given was that cane is still profitable relative to other farming activities, it is the best performing crop in the areas where it is grown and it also emerged that cane and sugar products have ready market.

The study revealed that farmers and millers use other means to mitigate the price fluctuations other than derivatives. The reason they use other means is because they are not aware of the existence of derivative instruments as a way of managing price risks and the other reason is that the instruments are not readily available in agricultural sector.

The other means used as alternatives include; building up stock of sugar in anticipation of better prices in future, increasing the smaller branded sugar packs since they are sold directly to supermarkets and convenient stores which seem to guarantee price stability over a longer period, and lastly to lobby Kenya Revenue Authority (KRA) to control cheap illegal sugar imports. Other means to mitigate price drops are to export if the markets in other countries fetch higher prices, and to ask for Kenya Sugar Board (KSB) and Ministry of Agriculture intervention to control imports.

As for cane prices, not much is done by the farmers since they are determined by a formula dependent on sugar prices. However, some respondents explained that they tend to maintain a long ratoon cycle of cane averaging up to ten in order to reduce their costs and also stick to good practices of crop husbandry (such as use of organic manure and fallow land for extended period) to keep costs as low as possible and yields as high as can be achieved.

It was observed that although there was little knowledge or none at all on the use of derivative instruments to lessen the price risks, if the farmers knew they existed and were readily accessible, they would use them. The respondents were however, skeptical about these instruments becoming available in sugar industry in the near future.

4.4.3 Weather Risk Management

When asked whether they suffered the effect of adverse weather in the industry, here is how they responded;

Table: 4 Do you sometimes get affected by adverse weather conditions?

	Frequency	**Percent**
Are you affected by drought	9	100%
Are you affected by floods	5	56%
Are you affected by any other adverse weather	0	0%

Drought was identified as the worst adverse weather condition affecting sugar industry. All the respondents explained that drought is becoming more frequent as weather pattern seems to be changing. The result is that every season between December and March there must be a dry spell which significantly lowers the yield per hectare and expose the cane crop to accidental wild fires.

Flood on the other hand, was also identified as a big challenge that affects the cane stalk, hence lower yields and cause staleness of cane delivered to the millers as the roads become inaccessible. The cost of haulage of cane from the farms to the factory also goes up during wet season.

On the issue of insurance against the weather risks, it emerged that insurance policy was deemed to be too expensive and therefore additional cost. Only one respondent had insurance policy against cane fire but not against drought or flood. Some respondents indicated that the risk of fire was worse than that of natural calamities such drought and floods and were considering an insurance cover in the future.

Since the effect of adverse weather like drought impacts a large area at the same time, it is deemed that the same effect on a small acreage of farm would be replicated in thousands of farms within the same geographical area. Hence a small sample such as the one used still adequately represents the whole population in the industry.

On whether the respondents had heard of Weather Index Insurance (WII), the answer was that all had no knowledge of existence of such instrument.

Table 5: Knowledge of Weather Index Insurance (WII)

	Frequency	**Percent**
Heard of Weather Index Insurance before	0	0%
Not heard of Weather Index Insurance	9	100%
Total	**9**	**100%**

As already pointed out, all respondents were not aware of the existence and usage of WII. It has not been used in the industry at any time. So how do the farmers in the industry mitigate against the risks posed by adverse weather?

The respondents indicated that other streams of income are targeted to reduce the low yields of cane and low production of sugar if bad weather strikes. The other sources of income enumerated included keeping livestock for either meat or milk, putting some acreage under forest, and farming soybeans. The millers further gave additional sources of revenue including making briquettes from bagasse, making ethanol, bottling portable spirits, bottling water, and generating electricity.

Table 6: Other revenue sources to mitigate adverse weather effects impacting cane farming

Additional Revenue Source	**No. of respondents**	**Percent**
Livestock farming	7	77.7%
Soybeans and other legumes	5	55.5%
Electricity Generation	5	55.5%
Making Briquettes	4	44.4%
Distillery	4	44.4%
Bottling water and Juices	3	33.3%
Ethanol	2	22.2%
Forestry	2	22.2%

4.5 Discussion

While the twin risks of price fluctuations and adverse weather effects are real and have devastating consequences to farmers and the industry as a whole, it is unfortunate that the means currently available to the farmers to mitigate the risks are not as effective as desired.

Although Massell (1969) advanced that to stabilize prices, Marketing Boards and Stabilization Funds needed to be established, in Kenya since the industry does not involve in significant exportation of sugar, and the demand is higher than production by about 200,000 metric tons per year (Institute of Economic Affairs, August 2005), a marketing board may not be relevant. There is however, the equivalent of Stabilization Fund, that is, Sugar Development Levy (SDL) but it is used as a revolving fund to loan farmers/ millers at concessionary rates to develop more cane for the industry and for factory rehabilitation. It is not applied to stabilize cane or sugar prices. From the research, the respondents indicated that they take cane prices as given by the sugar millers since they have no control over them.

Interestingly, most respondents had not heard of derivatives, the theory of futures markets (McKinnon, 1967) to control the risk of price instability but they still indicated that they would continue to do cane farming because alternative farming activities like livestock farming, soybeans farming, poultry among others do not pay as well as cane despite the volatility in prices. The industry is however, under threat from March 2014 when COMESA safeguards that have been in place for more than four years will cease to apply. The cost of producing sugar in Kenya is higher than any other country in the region and therefore allowing free importation of sugar could pose serious danger to the industry as it is least prepared to compete at the moment.

Weather risks on the other hand, especially drought was found to be more of a concern due to the frequency of occurrence and devastating effect when it occurs. Again the research found that the farmers are poorly prepared to handle the effects of drought. Weather Index Insurance (WII) or ordinary insurance was not embraced by the respondents interviewed. All interviewees had not heard of WII. The alternative activities that farmers resort to in order of priority to cushion against the weather risks include livestock farming (77.7%), Soybeans and other legumes (55.5%), Electricity generation (55.5%), Briquettes making (44.4%), Bottling water and juices (33.3%) and the least was forestry (22.2%).

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The objective of the study was to answer the question stated in section 1.2 of Chapter one, that is, to what extent are price and weather risk management practices applied in the Kenyan sugar industry sub-sector. The research findings presented revealed that the derivative instruments are not used in the sugar industry in Kenya. Although some respondents had heard of the instruments, they neither used them in their institution nor did they know of any institutions using them. All the sugar millers cum farmers sampled did not know that derivatives and weather index insurances existed and could be used as a means to reduce the undesirable effects of commodity price drops and adverse weather conditions.

The study revealed that the double problems of price fluctuations and adverse weather affect both the farmers and millers of sugarcane every so often thereby reducing their yields and incomes. Even though they do not apply price and weather risks management practices to lessen the problems, they have alternative mitigating practices which are however, not very effective.

To address price drops, the millers stock sugar in anticipation of better prices in future. Their tenacity to do this for a long period is limited by their funds requirement cycle, their storage capacity and cost and the effectiveness of institutions tasked with the responsibility for controlling imported sugar. The price of cane on the other hand, is dependent on the price of sugar so most of the time farmers take it as given by the millers. The available options to cushion cane price drops is to manage the cost side of cane by practicing good crop husbandry, fixing the soil by applying manure, and proper timing of plant and harvesting periods. Some large scale farmers are also considering irrigation as a better solution to frequent drought problems.

Ordinary insurance policy is not taken by the cane farmers since it adds to already high cost of growing cane. It emerged that insurance policy for drought and flood may not be readily available and that the farmers who responded thought that the cost of insurance would outweigh the benefit.

It was found out that in the areas where cane is grown, it was regarded as the best cash crop available. All the respondents strongly indicated that despite the challenges faced in the industry, they still preferred growing sugarcane. This is positive and good for formulating policies to grow the sector.

5.2 Conclusions

According to the findings of the study, it can be concluded that price and weather risk management practices are not applied in the sugar sub sector industry in Kenya. Nearly all the large scale farmers cum millers had not heard of the existence of the instruments to manage price fluctuations and adverse weather effects. Market derivatives such as futures, forward contracts and options as well as weather index insurance are still foreign in the industry and are not used at all. From the findings, if the instruments were available and did not add to the already existing costs significantly, the farmers would be willing to use them.

Since most of the sugar produced in Kenya is consumed locally, that is, there is insignificant quantity exported, the use of market or price derivatives my not be urgent at the moment in the industry as a way to manage price fluctuations. Other alternatives such as controlling imports will provide a suitable price stability whose benefit will trickle back to the farmers since the price of cane is a function of the price of sugar. However, with the lifting of COMESA safeguards scheduled for March, 2014, imports control will cease to be practical means to stabilize prices. The industry will suffer significantly if the safeguards will be removed.

Adverse weather effects is a serious threat to the farmers in the industry and need to be managed due to the frequency of their occurrence and the wide devastating impact they pose to sugarcane crop causing reduction in yield and income. From the findings, the farmers are least prepared for the problems caused by adverse weather and had no knowledge of weather index insurance or/and weather derivative instruments.

5.3 Recommendations

The sugar industry players particularly millers and farmers need to be exposed to price and weather risks management instruments with a view to adapting best practices of cane farming. The government through the Ministry of Agriculture, Livestock and Fisheries needs to take the leading role through strategic policy formulation that will incorporate ways of effectively dealing with price and weather risks. These two problems are of serious repercussions and cannot be left to the farmers alone to deal with. The future of the industry depends on how these two issues can be handled particularly in the face of expiry of COMESA safeguards coming to an end on 28th February, 2014.

5.4 Limitations to the study

The study had a limitation in the sense that the research was in an area where no application of what was under study existed. It was frustrating to get the same response that price and weather risks management instruments were not practiced in the industry. However, this also offers the opportunity for more research in the derivative instruments in Agricultural sector in general.

5.5 Suggestions for further study

Not much research work has been done in the area of how agriculture sector in general and sugar sub sector in particular can deal with the problems associated with agricultural commodity prices and the effects of bad weather. It is suggested that a study and recommendation to the government on how to incorporate strategic policies formulation in handling these twin problems be done in order to come up with policies to spur growth particularly in sugar sub sector which has enormous unexploited potential.

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Appendices

Appendix 1: Timetable for conducting the Research

Time in weeks	**Task to perform**
Week 1 (19th 23rd August, 2013)	Project Proposal Submission
Week 2-3 (26th August to 6th September, 2013)	Secondary data gathering and findings write up
Week 4 (9th-13th September, 2013)	Preparing the interview questions
Week 5-6 (16th– 30th September, 2013)	Primary Research / Data Collection
Week 7-8 (1st- 6th October, 2013)	Write up of findings/ Dissertation write up
Week 9- (7th- 11th October,2013)	Proof reading / amendments / binding
Week 10- (14th-18th October, 2013)	Dissertation Submission

Appendix 2: **Letter of Introduction**

Boaz Mak'Abongo,

P.O.Box 73435-0200,

NAIROBI.

The Managing Director,

……

……

Dear Sir/Madam,

RE: REQUEST FOR RESEARCH DATA

I am a student pursuing my Master degree in Business Administration (MBA)-Finance from The University of Nairobi. I am requesting to be allowed to collect data from your company between 23th September and 30thSeptember 2013 to aid me in my project. The information provided will be used solely for academic purposes and will be treated with maximum confidentiality.

Yours faithfully,

Boaz Mak'Abongo

Appendix 3: Questionnaires

(A) General Questionnaires

Date:

Location:

County:

Miller or Farmer:

Title of Respondent:

Q1. Have you heard of either Price or Weather risk management instruments?

A1. Y [ ] N [ ]

Q2. If so, do you know the companies or institutions using them?

A2.

Q3. Does your institution use one or both of them?

A3. Y [ ] N [ ]

Q4. How big is the acreage of your farm under cane?

A4.

Q5. Despite the challenges posed by price and weather risks, would you put more area under cane if you had more land?

A5.

Why

(B) Price Risk Management Questionnaires

Q6. You sell sugar among other products. Do you sometimes experience negative price fluctuations?

A6. Y [ ] N [ ]

Q7. If yes, what do you do as a company when sugar prices fall?

A7.

Q8. Have you heard of derivatives instruments (i.e. futures, forward contracts or options)?

A8. Y [ ] N [ ]

Q9. To what extent does your company use them to mitigate against price fluctuations risks?

A9.

Q10. If you knew derivatives lessen the problems of price fluctuations would you use them?

A10. Y [ ] N [ ]

(C) Weather Risk Management Instruments

Q11. You are engaged in sugarcane farming. Are you sometimes affected by adverse weather conditions such as drought or floods?

A11. Y [ ] N [ ]

Explain

Q12. Do you take insurance policy to reduce the risks of weather?

A12. Y [ ] N [ ]

Q13. If yes, is the cover (A) very expensive (B) expensive (C) fair (D) cheap or (E) don't know?

Q14. Have you heard of Weather Index Insurance (WII)?

A14. Y [ ] N [ ]

Q15. If yes, have you ever used WII as an instrument to manage weather risks?

A15. Y [ ] N [ ]

Q16. What do you do as a farmer to reduce weather risks that affect your sugarcane farming?

A16.

Q17. Do you have alternative source of income other than from cane farming?

A17. Y [ ] N [ ]

Q18. What are the alternative sources of income available to you that you would consider?

A18.