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Climate Change and Extreme Weather Survival Strategies for the Agricultural Sector: The Case of Blinkwater Mills

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Abstract

Climate change and extreme weather events have had a negative impact on agriculture and the availability of low-cost quality food for humans. Major incidents of climate change and extreme weather events include the El Niño Southern Oscillating (ENSO) cycle, which led to a drought that affected farmers in South Africa, resulting in price increases of basic foods. The aim of the study was to determine how farmers affiliated with Blinkwater Mills were impacted by extreme weather conditions and climate change and what corrective action was taken to overcome their effects.

This is a descriptive and exploratory study, and data was collected by means of in-depth telephonic interviews with 10 participants. The findings revealed that Blinkwater Mills was able to avert the full impact of the drought because the supplying farmers irrigate their land and they were, moreover, able to obtain maize from other sources in the province of Mpumalanga.

The findings of this study will contribute to the body of knowledge on the approaches millers can adopt to adjust to the effects of extreme weather conditions and climate change. Some solutions are suggested so that industry professionals can mitigate and adapt to changes in the agricultural sector.

Key phrases

Blinkwater Mills; drought; El Niño Southern Oscillating; supply chains and survival strategies

1. INTRODUCTION TO THE STUDY

Climate change and extreme weather events have had a negative impact on the global environment, agriculture and the availability of low-cost quality food for humans (Rosenzweig, Iglesias, Yang, Epstein & Chivian 2001:1). Therefore, the agricultural sector in developing and developed countries needs to understand what is at stake and to have appropriate strategies in place to prepare for climate change and extreme weather events. The effect of the drought associated with the El Niño Southern Oscillating (ENSO) cycle in South Africa between 2015 and 2016 resulted in an increase in the cost of basic foods such as maize (Early 2015:1). Small farmers were not able to meet their required quotas to supply mills with maize and this resulted in mills having to find alternative sources of supply (Latham 2016:1). The ENSO adversely affected South African farmers of all scales to varying degrees - some farmers were able to recoup losses and continue into the next season, whilst others were forced into bankruptcy (Sihlobo 2016:1).

It is important, therefore, that long-term survival strategies are established to assist basic food commodity producers who are adversely affected by the drought as well as those intermediaries who are dependent upon these farmers for agricultural commodities.

This is a descriptive and exploratory study using the case of Blinkwater Mills. Blinkwater Mills is situated in the Mpumalanga province of northern South Africa and is responsible for producing and supplying Super B maize meal to rural outlying areas of Mpumalanga and Limpopo (Super B 2016). The 50 commercial and 5-10 subsistence farmers affiliated with Blinkwater Mills were adversely affected by the recent drought, resulting in a shortage of maize supplied to the mill. In this context, the aim of this article is to examine the survival strategies that can be implemented by agriculturally dependent organisations when faced with extreme weather conditions. The objectives of this article were to determine: (1) the impact of extreme weather conditions on farmers supplying Blinkwater Mills; and (2) what corrective action Blinkwater Mills took to overcome the effect and impact of extreme weather conditions.

This article consists of four sections, namely, the theoretical perspective, the research methodology that guided the research, a discussion of the findings and, finally, implications and areas for future study.

2. THEORETICAL PERSPECTIVE

Despite the fact that the agricultural sector contributes minimally[1] to the gross domestic product of the South African economy, providing R66.7 billion (2%) at the end of the second quarter of 2016 (Stats SA 2016:1), the sector remains a vital contributor to rural job creation and an earner of foreign exchange (AgriSA 2018:1). The agricultural sector has an indirect role in the economy, which is propagated through backward and forward linkages with other sectors. The backward link addresses the purchases of intermediate goods and services from the manufacturing sector, while the forward linkages address the relationship created through the supply of raw material to meet industry needs (AgriSA 2018:1).

In addition, given the uncertainty around food security, much importance is placed on the agricultural sector (Grain SA 2015:1). The performance of the agricultural sector has been directly affected not only by political and economic unrest but also by the drought (GreenCape 2017:15).

2.1 Climate Change and the Effect on the South African Agricultural Sector

Climate change is a topic of controversy, with many debating its validity. Climate change is often referred to as global warming - the increase in average surface temperature on Earth (Hoffman 2011:1-10; Whitmarsh 2009:401). Karl and Trenberth (2003:1) explain that climate change is as a direct result of human-induced behaviour, namely, emissions associated with energy use, urbanisation & land use on local and national scales. The effect of climate change is huge (including changes in ecosystems, rising sea levels, severe weather events, droughts and rising temperatures) influencing global crop productivity (Lobell & Gourdji 2012:3). The ENSO cycle is a deviation from normal surface temperatures and has a widespread effect on ocean processes, global weather and climate (National Weather

[1] Even though the agricultural sector is recovering from a crippling drought, the sector has experienced growth and brought South Africa out from a technical recession (Ntshabo (2018:1).

Service 2016:1). El Niño and La Niña are the opposite phases of the cycle, with El Niño as the warm phase and La Niña as the cold phase.

Even though the agricultural sector in South Africa contributes a small percentage of the country's greenhouse gas emission (5%), it is a sector that is largely impacted by the effects of climate change (GreenCape 2017:19). Karl and Trenberth (2003:1) observe that the rate of change that can be expected as a result of climate change is unknown. However, the effect on the agricultural sector can be seen in the reduction of available surface water, the change in seasonal rainfall and runoff, increasing irrigation demands and a rise in the magnitude and frequency of flood events (GreenCape 2017:19).

2.2 Climate Change and the Effect on the Organisation

The literature on climate change is more comprehensive than the available literature on extreme weather conditions, which is limited (Glenhill, Hamza-Goodacre & Low 2015:15). Climate change and extreme weather conditions, although separate concepts, affect an organisation in similar ways. Both, when they occur, have the propensity to impact negatively on operations and functionality (Dasaklis & Pappis 2013:1140).

According to the Department of the Environment and Energy (2006:11), climate change and its resultant impact have changed over the years and will continue to do so in the years to come. The threat of climate change can no longer be ignored, as its impact would be substantial enough to force industries to take action. Dasaklis and Pappis (2013:1140) posit that there has been a shift in the stance taken by organisations. The authors believe that there is a move towards identifying threats and opportunities related to climate change and capitalising on this to create a robust climate change agenda.

At least 85% of global supply chains have been affected to varying degrees by disruptions in various forms (Deloitte 2013:4). Consequently, shareholders have experienced inferior returns and a reduction in future returns are also expected (Reed & Willis 2012:40). In view of this, Vasan (2014:1) believes that risks should be identified and managed before a disruption in the entire supply chain occurs.

The Intergovernmental Panel on Climate Change (2014:13) observes that compounded risks along a supply chain will generate new and altered risks for individuals and their natural environment. Donnelly (2015:1) notes that the drought in South Africa resulted in a decrease

of 29% in crops such as maize, sunflower, soya beans, groundnuts, sorghum and dry beans. An option available for South African organisations that require agricultural commodities and cannot source them locally is that of sourcing internationally (Viljoen 2016:1).

2.3 Survival Strategies to Overcome Extreme Weather

2.3.1 Decision Making Frameworks

In order for an organisation to develop a comprehensive and robust framework that speaks to making adaptations in the wake of change, there needs to be an in-depth understanding of organisational, structural and financial barriers. This is vital, as these barriers have the ability to hinder the execution of adaptation practices, the awareness of such practices and the perception of the logistics manager concerning climate change. Further to this, barriers also arise with the actual challenges of the adaptation, the implementation of these practices and the related costs of the transferability of such an adaptation approach (Dasaklis & Pappis 2013:1151). The Sustainable Development Solutions Network (2013:63) explains that Climate-Smart Agriculture is a site-specific assessment which uses specific agricultural technologies and practices to enhance productivity whilst ensuring the protection of the environment and surrounding communities.

Additionally, there is a method put forward by the South African government that is a two-pronged approach based on trial and error. The first aspect of the approach identifies valuable information relating to expected future value and viable mitigation responses together with “impact channels”, while the second summarises climate-related information in order to identify key areas of impact for critical sectors in the short, medium and long term (Department: Environmental Affairs 2013:1).

2.3.2 Integrated Landscape Management

Integrated landscape management seeks to realise benefits and reduce trade-offs among organisational specific objectives such as cost, quality and the meeting of consumer demands. Landscape management can be defined as the cooperation between land managers and farmers who actively seek to form partnerships with organisations, local governments and business in order to identify solutions to mutual problems (Sustainable Development Solutions Network 2013:68). The purpose behind integrated landscape management is to establish viable ways to sustain areas of growth where food production

and human welfare are of equal importance. Milder, Hart, Dobie, Minai and Zeleski (2014:68) believe that it is essential to inspire and maintain the landscape initiatives that are currently in place as a means of increasing learning and encouraging investments as well as ensuring record keeping.

2.3.3 Diversification of Crops

When faced with adverse environmental conditions, such as extreme weather, farmers are forced to change the crops and to create an adaption method to suit the situation at hand (Tirado & Cotter 2010:6). However, when choosing to make use of such crops, they must ensure that the environment created is controlled in relation to water-shortages, as this will ensure the effectiveness of the crop (Mozell & Thach 2014:85). If this is not done, it will impact negatively on the coping mechanism of the crops (Tirado & Cotter 2010:6). The Sustainable Development Solutions Network (2013:57) states that farmers should have access to a variety of high-valued and well-adapted seeds or hybrid seeds that are affordable, as this will manage the specific environment and market segments, which in turn will allow for the needs of the farmers to be meet.

In addition, Andrade (2016:2) suggests that farmers can plant a variety of crops rather than only one crop which will be affected in its entirety in drought or excessive rainfall conditions. The South African government has cultivated a variety of crops which, although they cannot continue indefinitely in these circumstance, are able to last between ten to fourteen days without water (Business Media Mags 2017:1). This breakthrough has come on the heels of the devastating drought which occurred during 2015 and 2016.

An alternative option to crop diversification is to alter the planting dates of crops (Shannon & Motha 2015:53). Grain SA (2011:1) states that, for commodity producers to achieve optimal yields, the planting dates need to be optimal in relation to the timing of the maize production cycle. The benefit of this approach is that farmers are able to plant earlier in the season. This is of value to the milling companies who depend on these farmers' yields, thus ensuring the continuation of operations. For example, Latin America produces two-thirds of the coffee utilised by Starbucks. The regions responsible for the cultivation and harvest of coffee beans have faced continuous excessive rainfall throughout the seasons. As a result, they are now planting a variety of crops with altered planting dates. (Schumann 2017:1). However, for

milling companies such as Blinkwater Mills which are dependent on a particular crop, the operational timeframe of planting and harvesting cannot be adjusted.

2.3.4 Relief Funds

Additional funds were allocated by the Minister of Finance for farmers who were severely affected by the drought. However, not all were able to benefit from these funds (Sihlobo 2016:16). As a result, Senwes, one of South Africa's leading agri-businesses, undertook an initiative whereby the private sector actively contributed towards assisting farmers who were under strain (Business Media Mags 2017:1). Support from organisations outside of the agri-industry resulted in a significant boost to the overall funds available to aid in relief efforts and to revive farming operations (Business Media Mags 2017:1). In addition to these efforts by Senwes there were also initiatives introduced that assisted farmers affected by the drought by AgriSA, a non-profit organisation in South Africa. For example, major corporate institutions such as Standard Bank, Pioneer and Sanlam have invested in South Africa's agriculture sector.

The South African government has offered various grants, funding and incentive schemes aimed at growing and promoting the agriculture sector (AgriSA 2017:1). The Sector Specific Assistance Scheme is a cost-sharing grant which allows financial aid to be applied for. The Isivande Woman's Fund is aimed at encouraging and empowering women in the agricultural sector. The Land Bank offers financial services to commercial farmers with the purpose of financing agri-businesses as well as making available financial products that will attract new comers to the agricultural sector (Land Bank 2015:1).

2.3.5 Sustainable Farming Techniques

Adequate irrigation systems are often expensive and as a result inaccessible to small-scale commodity farmers. However, micro-irrigation technologies can be tailored to address the needs of small farmers operating in a diverse environment and with limited capital investment (Below, Artner, Siebert & Sieber 2010:5; Müllera, Cramera, Harea & Lotze-Campena 2010:4314; Sustainable Development Solutions Network 2013:60). This method has proven to be successful, with the results reflecting an increase in the income of farmers, a fall in poverty and a rise in food security and nutrition as well as the creation of local business opportunities (Burney & Naylor 2012:110).

In addition to increasing the viability of the land through irrigation methods, adequate onsite storage facilities decrease the post-harvest challenges that face farmers. These post-harvest challenges include moisture loss, defects, diseases and spoilage (Sustainable Development Solutions Network 2013:60).

Having the correct tools and utilising the proper techniques is considered to be the best way for an agricultural producer to ensure sustainability. However, this is not enough, and an in-depth knowledge of the land, crops and market which is serviced is key for survival (Mozell & Thach 2014:86; Shannon & Motha 2015:53). It is essential that farmers consistently learn new skills and are made aware of options available to them as this will see the creation of sustainability capabilities, drawing on current practices and historical knowledge

2.3.6 Co-operatives

Co-operatives are independent associations made up of individuals who voluntarily come together with the aim of addressing mutual economic, social and cultural concerns (Department: Agriculture, Forestry and Fisheries 2013:1). Co-operatives are not restricted to the agri-industry but are found across various industries. Potential benefits that farmers derive from affiliating themselves with a co-operative include improving bargaining power, reducing purchasing costs, obtaining market access, broadening market opportunities, improving the quality of products and services, and procuring goods and services for individuals who would have otherwise not have access to these items, as well as creating a larger revenue for membership reimbursement (Macaskill 2016:1). For example, in the Mpumalanga province where Blinkwater Mills, the company that participated in this study, is situated, there are 209 agricultural co-operatives, of which 38 are crop co-operatives.

The advancement of co-operatives can be seen in the Nicaragua co-operative, which not only serves its members but the community at large. This highlights not only the importance of affiliation but also the communal growth and benefits derived from it (Department: Agriculture, Forestry and Fisheries 2015:1). It is from Nicaragua that the Body Shop sources sesame oil from small-scale farmers. These farmers face continual challenges associated with extreme weather conditions. However, the presence of the co-operative serves as a buffer to farmers and prevents widespread devastation and loss of income (Ray 2016:1).

2.3.7 Strategic Sourcing of Suppliers

Organisations can reduce risk brought about by climate change through strategic sourcing from their suppliers (Mvubu & Naude 2016:276). Organisations are driven by the need to reduce costs which in turn often dictates the suppliers that are chosen. This can be seen as an organisation trade-off between, on the one hand, the low transportation costs resulting from closer suppliers and, on the other, the loss of revenue which may be incurred when a major storm threatens the crops of suppliers all within the vicinity (Handova 2015:1).

In addressing the shortage of yield production in South Africa, an alternative is the sourcing of maize from international suppliers. Onyango (2017:2) lists the top five maize producing countries as the United States of America, China, Brazil, India and Argentina. These countries could be considered viable alternative maize sources should the commercial and substance farmers originally contracted no longer is able to deliver maize of an acceptable quality and quantity.

2.3.8 Contracts

Commodity producers can enter into a production contract that will set predetermined prices for desired commodities. With this type of contract and strict contract stipulations, famers do not have as much control (Shannon & Motha 2015:53). Alternatively, farmers can make use of crop yield insurance, which provides protection for farmers against financial loss when faced with extreme weather affecting production (Below *et al.* 2010:11).

Micro-insurance is another method which farmers can employ actively to protect themselves against weather related crop failure. Micro-insurance can be administered and run via co-operatives in developing nations (Thorpe & Fennell 2012:7).

2.3.9 Organisational Strategy

Climate change does not only affect the operation of an organisation's supply chain but also has implications for strategic and operational managerial levels (Below *et al*. 2010:12). At the strategic level, re-configuration of the supply chain network, low energy intensive assets and overall efficiency are affected, whereas at the operational level, planning, insurance costs and inventory controls are some of the issues which require attention (Dasaklis & Pappis 2013:1148).

The Department of Environment and Energy (2006:26) believes that climate change should be incorporated in organisational planning through a climate change scenario which serves to provide useful information regarding the strength, direction and overall trend of climate change. There are various ways in which farmers and those closely affiliated can recover from the effects of extreme weather conditions. However, given that climate change is a phenomenon with a continuous presence, organisations must be prepared for all possible scenarios to impact negatively on and disrupt daily activities.

3. RESEARCH METHODOLOGY

This article reports on a descriptive and exploratory study that was conducted to determine the impact which extreme weather conditions had on farmers affiliated with Blinkwater Mills and what survival strategies could be implemented by agricultural organisations. Due to the descriptive and exploratory nature of the study, a qualitative research approach was deemed appropriate to address the research objectives. This approach provided the authors with a deeper understanding of the relevant phenomena (Saunders, Lewis & Thornhill 2016:168). The research process included a review of literature to assist with understanding the phenomena and the formulation of the interview questions.

3.1 Target population

The total target population of Blinkwater Mills, Mpumalanga is presented in Table 1.

Table 1: Target population of Blinkwater Mills

	Position	**No. of Participants**
Blinkwater Mills, Head Office	Senior level	10
Mpumalanga Depot	Depot controllers	4
Limpopo Depot	Depot controllers	4
Highveld Depot	Depot controllers	4
Total target population		**22**

Source: Authors' own construction

3.2 Sample Design

A non-probability judgement sampling to select participants at Blinkwater Mills was deemed appropriate for this study. Participants consisted of four senior level staff members from Blinkwater Mills head office, two participants from the Mpumalanga depot, two participants from the Limpopo depot and two participants from the Highveld depot.

3.3 Data instrument

The interview guide consisted of closed- and open-ended questions and was pre-tested with two managers from Blinkwater Mills to ensure that the questions were clear and unambiguous. The questions were phrased in lay language to capture all aspects of the factors to be measured. The consisted of three sections as follows:

Section 1: The aim of this section was to determine the impact of extreme weather on the farmers associated with Blinkwater Mills.

Section 2: The aim of this section was to determine the impact of extreme weather on the upstream operations (from farmer to mill) and the downstream operations (from mill to consumer) of Blinkwater Mills and to identify any survival strategies in place.

Section 3: The aim of this section was to determine what corrective action Blinkwater Mills had taken to overcome the effect of the extreme weather conditions.

3.4 Data Collection

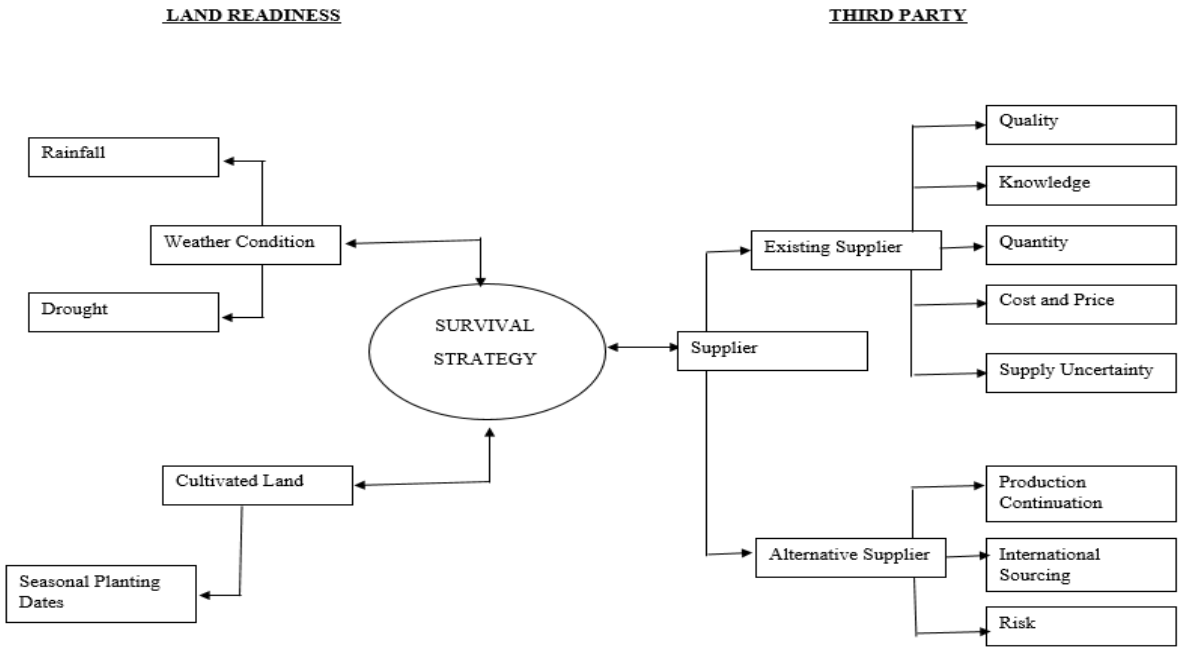
The empirical data collection for this study consisted of telephonic semi-structured interviews with the participants. Telephonic interviews were used because the researcher was based in a different province to Mpumalanga. Bryman, Bell, Hirschsohn, Dos Santos, Du Toit, Masenge, Van Aardt and Wagner (2014:217) posit that telephonic interviews are extremely successful in business research. Prior to the interviews taking place, the researcher drew up an interview schedule with the general manager of Blinkwater Mills. Each participant was given a formal introductory letter that provided insight into the study being undertaken and a copy of the interview guide. This provided the participants with the opportunity to ask questions and seek clarity before responding to any questions. In this way, consistency and accuracy were maintained during the interviews, which contributed to the trustworthiness of

the results of the study. During the interviews, the participants' answers were written down and all responses were transcribed in a uniform, organised manner.

3.5 Data Analysis

Data was analysed using thematic analysis. Thematic analysis is "an approach to dealing with data that involves the creation and application of 'codes' to data" (Creswell & Plano Clark 2007:88). Thematic data analysis took place in the following stages: organising the data in a manner which prioritises and reduces the data; finding organised ideas and concepts through careful reading and re-reading of the data; searching for themes; reviewing the themes; and organising the information into a formal format. The data was then organised into codes, categories and themes and a thematic map was constructed. Figure 1 presents the thematic map demonstrating the findings of the data analysis. The main themes identified in this study are ***Land Readiness*** and ***Third Party***. The subsequent sections of this chapter will 'unpack' these themes.

Figure 1: Thematic map



Source: Authors' own construction

4. RESULTS AND EXPLANATION OF THE FINDINGS

Blinkwater Mills is situated in the Mpumalanga province of northern South Africa and is responsible for producing and supplying Super B maize meal to rural outlying areas of Mpumalanga and Limpopo (Super B 2016:1). The farmers who supply Blinkwater Mills were adversely affected by the recent drought. This resulted in a shortage of maize supplied and a subsequent increase in the price of maize. Table 2 presents the profile of the participants

Table 2: Participant profile

Participant	Place	Level of Management
Participant 1	Blinkwater Mills (Head office)	Senior Level
Participant 2	Blinkwater Mills (Head-office)	Senior Level
Participant 3	Blinkwater Mills (Head office)	Senior Level
Participant 4	Blinkwater Mills (Head office)	Senior Level
Participant 5	Mpumalanga Depot	Middle Level
Participant 6	Mpumalanga Depot	Middle Level
Participant 7	Limpopo Depot	Middle Level
Participant 8	Limpopo Depot	Middle Level
Participant 9	Highveld Depot	Middle Level
Participant 10	Highveld Depot	Middle Level

Source: Compiled by the authors

4.1 Theme 1: Land Readiness

At the beginning and end of every season, farmers must ensure that their land is properly demarcated and cultivated in keeping with the requirements of crop production (du Plessis 2003:13). It takes time and continuous effort for farmers to ensure that the land is ready, and farmers understand that, because they were successful in one season, this does not mean that future seasons will be as successful (Sihlobo 2016:1). Ensuring that land for crop production is in optimal condition is the culmination of numerous factors. These factors

include understanding the needs of the land, having the correct irrigation methods and knowing when to plant specific crops, given the success rate and needs of the surrounding community (Bendile & Eybers 2015:1).

4.2 Weather Conditions

Weather conditions are essentially atmospheric conditions which make up the state of the atmosphere, be they temperature, wind, clouds or precipitation. Some types of weather conditions are cold, drought, dry, hot, wet, windy, sleet and snow (Lobell & Gourdji 2012:3). Since South Africa is situated at the southernmost tip of the African continent, it seldom experiences snow and sleet to an extent that would impact on the agricultural industry. However, it is does experience rainfall and drought. South Africa's climate varies: the south-western corner of the country experiences Mediterranean conditions, the interior plateau experiences high temperature conditions, and the north-east, where Blinkwater Mills is situated, experiences subtropical conditions (du Plessis 2003:13). Farmers affiliated with Blinkwater Mills are situated in the Mpumalanga province and farm on drier land with a limited water supply. Despite their knowledge of irrigation and land recovery, the impact of the recent drought over an extensive period of time set countless farmers back for that season and those to come.

4.2.1 Rainfall

In the industrial sector, farmers are heavily dependent on water to soften the soil before seeds are planted and the crops begin their germination process. Usually this water comes in the form of rainfall, as irrigating is costly; given the water shortage crisis and the drying up of boreholes, farmers are thus heavily dependent on rainfall to assist in this process (Sustainable Development Solutions Network 2013: 5). Without achieving this critical step, farmers are not able to successfully produce yields that are of viable quality. While rainfall cannot be controlled by farmers, survival involves an understanding of the rainfall patterns when planting crops that require significant amounts of water.

The province of Mpumalanga experienced very little of the effects of the ENSO cycle, experiencing some rainfall despite the severe drought conditions across the country. However, not all the farmers affiliated with Blinkwater Mills benefited from the rainfall. As Participant 7 indicated:

"*The farmers that are associated with Blinkwater Mills experienced two extremes. Some farmers experienced very little rain while others experienced an optimal amount. As a result, those farmers who experienced less than enough rainfall during the initial stages produced a smaller yield, while those farmers who experienced sufficient rain had a higher yield*."

Farmers can plan and prepare to the best of their ability; however, rainfall is a factor that they cannot control and that impacts on the quantity and quality of yield produced. Participant 2 explained:

"Some of the farmers who are located near to Blinkwater Mills experienced enough rain during the season, while others did not. From this, those farmers who benefited from the rain had a positive return due to the higher prices they were now able to command. For those farmers, who were not as fortunate, were not able to benefit from an opportune situation where good money could be made."

Farmers that experienced the required rainfall for softening the soil and promoting germination and growth harvested the desired level of yield. This ensured that they were able to meet contractual obligations as well as demand a higher price for their crops.

4.2.2 Drought

The effects on farmers of the drought varied. Some were able to continue with minimal disruptions, while others were not so fortunate. The widespread drought not only affected the cultivation of crops but also the livestock farmers. Participant 3 stated:

"*It is not only yield production that is affected as a result of the drought. Farmers that have livestock on their land also experience difficulties, given that the drought hinders and decreases the grazing hectare. And given that the yield production is affected, it affects and limits the availability of animal feed."*

4.2.3 Cultivated land

Cultivation is the preparation and use of land for the growth of crops. Tilling is considered to be the basis in any crop production system and is the single largest cost contributor in the production of maize (du Plessis 2003:12). An important factor to be considered in any new season is the quality of the land and soil, and farmers must pay careful attention to as it is a

determinant to the success or failure of their overall yield. Therefore, the texture and fertility of the soil needs to be tested to determine the current level of quality and, if improvement needs to be made, the soil is brought up to the required standard.

Nevertheless, having good soil is not enough as there are other external factors which impact on the cultivation of land, namely, rainfall patterns and drought. The impact of either can prove to be devastating. The farmers affiliated with Blinkwater Mills have tilled the land for many years and are well versed with what is required of them and when. They have learnt from previous generations how to read the climate and adjust accordingly when the need arises.

4.2.4 Seasonal Planting

To ensure that all factors work together to prepare land that is ready for successful cultivation, it is vital to consider the agricultural seasons. The timing of land cultivation and preparation must coincide with the seasons in which the crops yield best. Farmers must identify the months of the year that are ideal for the production of the crops. Participants were asked whether farmers affiliated with Blinkwater Mills required additional time to recover before resuming normal operations as a result of the drought. Participant 10 stated:

> *"No, farmers did not require additional time to recover from the drought because the planting time for maize is set and it is the same every year. This time frame is known by farmers and followed stringently to ensure optimal harvests.*"

Participant 2 echoed this sentiment:

> *"From year to year, the time frame for planting to harvesting remains the same. There were farmers that were identified by Blinkwater Mills who were negatively affected by the drought and could no longer farm.*"

Farmers are held to a strict and well-established cycle because crops are season sensitive and require specific conditions to ensure that production occurs optimally. Production of maize occurs during a set interval, which ensures that Blinkwater Mills not only receives the best yield but can also properly prepare for the season ahead. Planting time is considered to be "bound" and cannot be extended.

4.3 Theme 2: Third Party

Organisations transfer key operational activities to third parties that have the ability, capability and expertise to produce a product or render a service better than the organisation can do in house (Hugo & Badenhorst-Weiss 2015:208). Blinkwater Mills makes use of suppliers from the surrounding Mpumalanga area. The reason for using suppliers strategically based near the mill is to reduce transportation costs and ensure that the maize is delivered timeously. This in turn facilitates the continuous operation of the Blinkwater Mills turbines.

4.3.1 Existing Suppliers (Affiliated Farmers)

It was found that, even though Blinkwater Mills has established long-term relationships with affiliated farmers over the years, they tended to maintain some distance in the relationship. This can be attributed to the fact that Blinkwater Mills is unwilling to share the risk borne by the farmers. Affiliated farmers are given first preference once harvesting is complete. Because of the drought, the quality and quantity of the maize supplied to Blinkwater Mills has been below the norm. This was found during the grading process. Despite the farmers' having in-depth knowledge of the land and of the best ways to overcome drought conditions, the effect of the ENSO was too severe for a sustainable remedy. Consequently, the farmers charged more for maize - a cost which Blinkwater Mills could not absorb and which resulted in consumers paying more for Super B maize meal.

4.3.2 Quality

The participants were asked if the quality of yield received from affiliated farmers was affected by the drought. It was found that the drought had impacted on the quality and this had affected the farmer and Blinkwater Mills. Participant 2 indicated:

> *"Farmers that had enough rain were able to ensure that the yield produced was up to the required standard. However, for the majority of the farmers who did not have enough rain, the quality of the yield produced on their land was not up to the acceptable norm. This was clearly evident to us during the grading process.*"
>
> *"The quality of our product was directly affected as a result of lower quality maize being used as a result of the drought, in the production of maize meal."*

4.3.3 Knowledge

Processing the knowledge related to a specific area of farming land takes years of practice to develop through trial and error. When participants were asked if their affiliated farmers are suitably equipped with the skills and knowledge regarding harvesting times and farming conditions to handle extreme weather conditions, Participant 5 stated:

> *"Yes, I do believe that the farmers associated with Blinkwater Mills are experienced enough and would therefore be in an advantageous position to handle these adverse conditions when they arise. However, even with this being said, there is a limit to which farmers can prepare in the anticipation of the severity of the drought."*

It was found that farmers affiliated with Blinkwater Mills have proven to be skilful and experienced when handling drought conditions. Affiliated farmers have an understanding of the land and the requirements that go into making a profitable season. Participant 4 stated:

> *"All the farmers that are affiliated with Blinkwater Mills have been a part of the continuous growth of the organisation throughout the years of operations. Each of our suppliers have been carefully selected as we strive to inculcate quality. Therefore, we employ farmers who have years of experience in the farming industry in South Africa.*"

It was further found that the farmers belonging to the farming industry of South Africa are held in a high regard amongst the farming and milling community. Such individuals are considered to be responsible and reliable in the production of their crops as well as in their overall operations.

4.3.4 Quantity

Blinkwater Mills' survival is dependent on the farmers supplying a yield sufficient not just for the season but also including extra reserve stock in case of a disruption in the transportation schedule. It was found that the quantity of yield received from the farmers was affected by the drought, as highlighted by Participant 3:

> *"Yes, the expected yield which we received from our respective farmers was less than usual. However, we were not the only ones that were affected as this was also the case for much of South Africa. Some of the other maize mills had the option of imported maize as an alternative to the decrease in yield received while smaller mills were forced to close down for the rest of the season."*

4.3.5 Cost and price

The findings revealed that the drought had a negative impact on the cost of maize, since demand exceeded supply. Blinkwater Mills had to pay the higher cost of maize charged by farmers. Participant 2 stated that:

> *"Overall the drought in South Africa resulted in higher maize prices being charged by farmers who could produce a good yield, which in turn also affected us directly. Consequently, we were also needed to sell our end product of maize meal at a much higher price to our consumers. This in turn had an effect on our sales' volumes which decreased."*

Participant 6 concurred:

> *"Yes, we at Blinkwater Mills were forced to increase our maize meal price as a result of higher maize prices that were charged by our affiliated suppliers. The presence of the drought caused the price of maize to be higher which made it difficult for Blinkwater Mills' consumers that are based in rural areas to afford the maize meal at the higher price."*

4.3.6 Supply uncertainty

Farmers who were affected by the drought could not supply sufficient yield to the milling companies. It was found that, whilst some farmers were able to continue to supply Blinkwater Mills with the agreed tonnage, others were less fortunate and required financial assistance as mentioned by Participant 2:

> *"Some of the farmers associated with Blinkwater Mills lost their positive cash flows as a direct result of the drought. This is due to them not being able to produce sufficient crops at the required grade. Consequently, these farmers needed financing and early or prior payments from Blinkwater Mills as a means of sustaining their operations to a certain degree."*

4.3.7 Alternate Suppliers

In view of the drought and the vast number of consumers serviced by Super B, it was necessary for Blinkwater Mills to ensure continuity in their operations. Therefore, suppliers who were unable to meet their contractual obligations to supply Blinkwater Mills with a

determined amount of maize were bought out of their contract and an alternative supplier was sourced. Although Blinkwater Mills shares a long-standing relationship with their suppliers, the milling company does not take on the risk of lack of production. Alternative suppliers able to meet the maize quantity needs of Blinkwater Mills were used for that period of time as a buffer against production uncertainty.

4.3.8 Production Continuity

Since Blinkwater Mills relies on continued output to meet customer demand of the Super B product, they require a constant supply of maize. Blinkwater Mills was forced, as a result of the drought, to identify alternative suppliers to meet the immediate shortage created when affiliated farmers were not able to deliver the crops as obligated. Through an analysis of their supply chain, Blinkwater Mills determined that it was their upstream supply chain that is most affected by the drought. When asked why and how their production was able to continue without delay, Participant 2 indicated that:

> *"At least 80 percent of the total costs Blinkwater Mills incurs are made up of fixed costs, as a result it is paramount that production continues. This in turn ensured that the mills are poised for producing maximum output at all times. Therefore, we ensure that we have a constant supply of raw materials which allows for the continuation of the mills."*

4.3.9 International Sourcing

In addition to sourcing locally, Blinkwater Mills also had the option of sourcing internationally. However, given the immediate need for production continuity, an international supplier would not be viable, with the time it would take to identify, evaluate and contract such a supplier. International sourcing is also a costlier alternative and, since there is sufficient maize production in Mpumalanga, the sourcing of maize from an international source is not required:

> "*No, this is due to the quality of international maize not being good enough. We are accustomed to a certain standard and have expectation of the maize we purchase, which we at Blinkwater Mills believe that internationally, it does not meet our expectations. Consequently, we would not want our product to be negatively affected by the poor quality of internationally sourced maize" (*Participant 2).

4.3.10 Risks

Risks can be found internally and externally in Blinkwater Mills, internally as the risk of production disruption and externally as the risk of suppliers being unable to deliver as per contractual obligations. Participants were asked if the risk of inconsistent yield as a result of extreme weather conditions is shared between Blinkwater Mills and their farmers, to which Participant 1 responded:

> "*Blinkwater Mills and their individual farmers cover their own risk. Therefore, when the drought occurred, it was the responsibility of the farmer to initiate recovery measures. This responsibility did not fall onto Blinkwater Mills, as we do not have measures in place to minimise the risks that affect our farmers."*

Blinkwater Mills does not engage with suppliers further than establishing a relationship. There is no integration or sharing of organisational resources to overcome and establish control mechanisms in the wake of a supply chain disruption.

4.4 Blinkwater Mills' Corrective Action to Overcome the Impact of Extreme Weather Conditions

The aim of this section was to find out how Blinkwater Mills deals with the impact of extreme weather conditions. Table 3 summarises the impact of extreme weather on the farmers associated with Blinkwater Mills and the corrective action taken by Blinkwater Mills to overcome these constraints.

Table 3: Impact of extreme weather and corrective action taken by Blinkwater Mills to overcome the constraints

Theme	Impact of extreme weather	Corrective action taken by Blinkwater Mills to overcome the constraints
Theme 1: Land readiness	**Category 1:** Weather condition • Rainfall • Drought	These factors directly impacted the cultivation and operations of the affiliated farmers which indirectly impacted on Blinkwater Mills. In order to overcome this constraint, maize was sourced from alternative farmers to compensate for the shortage of supply

	Category 2: Cultivated land • Seasonal planting dates	from the originally contracted farmers.
Theme 2: Third party	**Category 1:** Existing supplier • Quality • Knowledge • Quantity • Cost and price • Supply uncertainty **Category 2:** Alternate supplier • Production continuation • International sourcing • Risks	Blinkwater Mills sourced maize from alternative farmers in an attempt to recoup losses from originally contracted farmers since these farmers' crops were affected by the drought. The preferred choice, given cost, availability and established supplier networks, was to source alternative suppliers that were located within the Mpumalanga province.

Source: Authors' own construction

5. CONCLUSION

The purpose of this study was to determine the impact extreme weather conditions had on farmers affiliated with Blinkwater Mills and what survival strategies could be implemented by agriculturally based organisations. A case study of Blinkwater Mills was conducted and the findings revealed that the drought had a negative impact on the yield of maize. Therefore, their affiliated farmers were not able to meet the demand. In order to address this challenge, Blinkwater Mills sourced maize from alternative farmers in Mpumalanga. Despite Blinkwater Mills incurring additional transportation costs, they were able to continue production, subsequently charging consumers more for Super B.

The main limitation of the study was the population size. Given the nature of operations at Blinkwater Mills and the size of the organisation, not many are privy to operational information and sourcing activities, therefore nullifying unbiasedness.

Recommendations for Blinkwater Mills would be to identify and form a strategic supplier base to be used when originally contracted suppliers are unable to meet their expectations due to unforeseen reasons. Investment in hedge inventory would see Blinkwater Mills not only having buffer stock but also having enough reserve stock on hand for any unforeseen future uncertainties. Formulation of a framework for dealing with risk would serve as a formal contingency plan for more than the cases when extreme weather disrupts the operations; it would also provide more awareness locally of the plight of farmers and encourage active engagement in relief efforts.

Areas for future study could include the following: the impact of extreme weather on the agricultural industry, especially from a South African perspective; the viability of farmers engaging in micro-insurance through already established co-operatives which would protect them against market place and environmental uncertainties; integrated landscape management that would require government or the private sector to actively evaluate the land and equipment needs of farmers and to provide farmer specific aid; and the feasibility of sustainable farming techniques for small-scale farmers, given that these farmers feed into commercial farmers.

There is a dearth of information regarding extreme weather survival strategies for agriculturally based organisations, especially in South Africa. However, given the infancy of this concept, there will continue to be new and innovative ways in which agriculturally based organisations can survive the effects of extreme weather conditions. No two organisations can function with the same survival strategy; therefore, doing a thorough situation analysis will aid in the development of contingency plans. Blinkwater Mills was able to successfully sustain their operations through not taking on the risk of their affiliated suppliers and the contracting of farmers situated further afield. Their survival strategy proved its credibility and reliability in the face of national agricultural devastation.

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