



Received: 26 June 2017  
Accepted: 22 November 2017  
First Published: 27 November 2017

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## PRODUCTION & MANUFACTURING | RESEARCH ARTICLE

# An assessment of the impact of disaster risks on dairy supply chain performance in Zimbabwe

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**Abstract:** This study investigated the impact of disaster risks on the performance of Zimbabwe's dairy supply chains. The study was initiated on the premise that Zimbabwe is at high risk and is highly vulnerable to disasters such as drought, cyclones, floods, animal diseases, and crop pests. This study employed a mixed method approach that involved the use of structured questionnaires, semi-structured interviews and observations. A combined total of 92 dairy farmers and milk processors were sampled from a target population of 122 from major milk producing regions in the country, with a response rate of 85%. Key informants, comprising 18 dairy authorities and 30 retailers were purposively sampled. Chipinge, Mutare, Harare, Gweru, and Bulawayo, were the regions under investigation, covering the greater part of the country. The findings computed through Ordinary Least Square regression analysis, indicated that an overall index of disaster risks impacted negatively on dairy supply chain performance. Major indicators of the disaster impacts were job losses, food insecurity, reduced milk productivity, and the general retarded growth in dairy businesses. The results were also corroborated by outcome of interviews with key informants. This study recommends that both the private sector and the government should invest in disaster reduction strategies, to enhance the effective and sustainable performance of dairy supply chains in Zimbabwe. The

### ABOUT THE AUTHORS

The authors' interest areas are in disaster risk management. The focus is in establishing the strategies that may be implemented in reducing the impact of disasters in various industries in developing countries that are the most affected by disasters such as Zimbabwe. The authors are also interested in the possible hindrances that thwart the efforts by governments, NGOs and private sector organisations to reduce the vulnerability of communities to disasters.

### PUBLIC INTEREST STATEMENT

This study investigated the impact of disaster risks on the performance of Zimbabwe's dairy supply chains. The findings show that overall disaster risks negatively affect dairy supply chain performance in the country. Major indicators of the disaster impacts were job losses, food insecurity, reduced milk productivity, and the general retarded growth in dairy businesses. The study contributes to the literature on disaster risks, which is lacking in most developing countries. Further more, practicing managers, particularly those in the dairy sector, will draw some lessons from this study in dealing with disaster risk related issues. The other important issue is that findings can also be repurposed to assist policy makers on enacting policies and improve existing ones to assist communities faced with disaster risks. Conclusively the study recommends that both the private and public sectors should invest in disaster risk reduction strategies, to enhance the effective and sustainable performance of dairy supply chains in Zimbabwe.

findings from the study contribute to literature on disaster risks, which has largely been under-explored in developing countries, will also assist practicing managers, particularly in dairy sector, in dealing with disaster risk issues. Similarly, the study findings will assist policy makers to consider enacting policies, and improve existing ones, to assist communities faced with disaster risks.

**Subjects: Supply Chain Management; Hazards & Disasters**

**Keywords: dairy farmers; job loss; agriculture; productivity; strategies**

### 1. Introduction

The increase in intensity and frequency of disaster risks has been ranked a major concern by supply chain practitioners, as it disrupts the performance of supply chains in any nation, including Zimbabwe. The successful transmission of goods and services from the manufacturer to the consumer requires a transparent supply chain network that will meet the current and future global demands. Zimbabwe experiences a number of natural and man-made disasters that include road traffic accidents, severe climatic and weather conditions, hydro-meteorological disasters, droughts, army worm invasions, floods, electrical power outages, and social and political volatility (Betera, 2011, p. 2). Risks like unanticipated climate change, famine, and cattle diseases are covariate in nature (The World Bank, 2011a). Zimbabwe's droughts of 1982, 1992, and 2015 had costly indirect consequences such as price increases, increased food imports, migration from rural to urban areas, and step-like changes in environmental degradation (Dairibord Holdings Limited, 2015). Due to interlinkage of economies across the world, nations are sensitive to disasters, regardless of their geographical position (Reddy, Anbumozhi, & Singh, 2016, p. 32). Climate change is anticipated to pose greater challenges to agricultural food production, and consequently affects downstream agro-based manufacturing industries (Governance and Social Development Resource Centre [GSDRC], 2009). The dairy sector in Zimbabwe is not spared from the adverse effects of these natural and manmade hazards. They have negatively affected the livelihoods of many households, who take dairy products as a major component of their food basket through food insecurity. Erratic power supply causes significant problems to the dairy supply chain, leading to long equipment breakdown time, idle capacity utilization and low-capacity utilization (The World Bank, 2011b, p. 15). According to Sodhi and Tang (2012, p. 10), the current increase in international trade has given birth to a global supply chain that is long and complex, which in turn brings an increased level of disruptions in the same supply chains. Major disasters such as the floods in Thailand in 2011 and Hurricane Sandy in 2012 in the United States of America (USA) has brought an increased interest on impact of disasters to the private sectors, globally. Factory Mutual Insurance Company (2014, p. 4) noted that companies that have significant investments and dependence on supply chain in China, fear that natural disaster in the host country would make them incur far reaching negative consequences on the performance of supply chains. It is evident that supply chain disruption in China will slow down the world's economic growth, as the country is a major exporter as well as importer of the world's goods and services. This study, therefore, sought to assess the impact of disasters risks on Zimbabwe's agricultural sector, in general, and on dairy supply chains in particular. The current state of knowledge in the field of disaster risk research in Zimbabwe unveils the prevalence disaster risks. It is to the best of these researchers' knowledge that this is the first time an investigation has been carried out on the impact of disaster risks on performance of dairy supply chains in Southern Africa particularly in Zimbabwe.

The objective of this research was to investigate the impact of overall disaster risk index on performance of dairy supply chains in Zimbabwe. Performance of dairy supply chains was measured using four proxies of job losses, food security, business growth, and milk productivity.

The next section of this paper reviews the empirical studies on disaster risks, and the economic and political situation that impacted the dairy supply chain in the country. The other sections look at

the research methodology employed before concluding with data presentation, analyses and discussion of results. This study is closed by concluding remarks, and some recommendations.

## 2. Literature review

### 2.1. *The concept of supply chain*

A supply chain refers to all the stages involved, directly or indirectly in fulfilling a customer request. Subbaiah, Rao, and Babu (2009, p. 1), define a supply chain as an integrated system in which various business entities such as suppliers, manufacturers, industrial customers, distributors and retailers work together to address issues of both material flow and information flow. The supply chain is composed of an array of activities including procurement of materials from suppliers, transportation of materials to facilities, production of goods at facilities, transportation of goods from facilities to warehouses and transportation of goods from warehouses to customers. Chopra and Meindl (2004, p. 12) indicate that a supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. In addition, Kemokai (2012, p. 32) argues that dairy supply chain relationships in Kenya not only include the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. In essence, supply chain activities begin with a customer demand and end when a satisfied customer has paid for his or her purchase. Kemokai (2012, p. 42) outlines that the term supply chain conjures up images of product or supply moving from suppliers to manufacturers, distributors, retailers and customers along a supply chain. It is therefore important to visualize information, funds, and product flows along both directions of the chain. Martin (1998, p. 8) recognises that one of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities but rather as supply chains. Kemokai (2012, p. 33) concurs with Martin (1998, p. 4) by propounding that in the modern competitive business environment the ultimate success of the business will depend on management's ability to integrate the company's business network to sustainable and reliable levels. Organisations are reliant upon having effective supply chains or networks to successfully compete in the global market economy (Naslund & Williamson, 2010, p. 11). Businesses rely on the supply chain for survival through the flow of information, goods and funds between different stages of the supply chain (Chopra & Meindl, 2004, p. 3). This article thus aims to shed light on the impact of disaster risks on stakeholders in the dairy supply chain in Zimbabwe. In the next section, the researcher looks at the impact of disasters on the supply chain of both developing and developed countries.

### 2.2. *Global disaster risks*

Disasters are a global challenge affecting all regions in both developing and developed countries. Whilst all countries suffer from disasters, low income countries are more susceptible to the impact of disaster risks. Developing countries such as Uganda, Mozambique, Ghana, and Kenya are leading countries affected by natural disaster risk. In Mozambique, the impacts of droughts, floods, cyclones and earthquakes have affected agricultural supply chains in the past 50 years, resulting in an estimated yearly deficit in cereals of 5,00,000 metric tonnes (Disaster Risk Financing & Insurance Program (DRFIP) & Global Facility for Disaster Reduction & Recovery (GFFDRR), 2012, p. 10). The poor state of the road network and high transport costs, due to the effects of disasters, hinder the movement of goods between the surplus producing regions in the north and the south, where the risk of production deficits is the highest.

In the same way, the 1999–2001 and 2008–2011 droughts in Kenya impacted directly on agriculture, resulting in increased costs of production, leading to a decline in economic growth and inflation (Government of Kenya, 2012, p. 40; Murigi, 2013, p. 972). In relation to the above, El Nino floods resulted in the busting of river banks which resulted in the destruction of bridges and property damages, affecting an estimated 1.5 million Kenyans (Ngecu & Mathu, 1999, pp. 277–284). The World Bank (2011b, p. 15) concurs with Murigi (2013, p. 972) on the negative consequences of disaster risk. As a consequence of erratic power supply and increased frequency and severity of droughts in Uganda, milk production is undermined due to low-capacity utilization, high electricity supplementary costs, lack of water and depleted natural pastures (The World Bank, 2011b, p. 15). This

development, in essence, implies that milk production is adversely affected by the prevalence of such risks as they cause notable instability in milk production, thereby leading to financial losses to the cattle farmers and the entire supply chain.

Zimbabwe is not spared from these natural disasters for it has started experiencing the effects of climate change as evidenced by erratic rainfall patterns, extreme temperatures, tropical cyclones and floods (Brown et al., 2012, p. 3). Chagutah (2010, p. 20) notes that Zimbabwe in particular is at high risk and very vulnerable to these climate changes because of its heavy reliance on rain fed agriculture. The unbearable high temperatures resulting from the heat wave are shrinking the country's main farming regions, resulting in the expansion of the dry regions that are less productive (Manyeruke, Hamauswa, & Mhandara, 2013, p. 271). The low rainfall recorded across the country is making dairy cattle breeding more difficult by the day as cows require abundant pastures (Masama, 2013, p. 49). Additional negative effects of the natural disasters in Zimbabwe, particularly experienced in the year 2000 from a tropical cyclone named Cyclone Eline, caused landslides and flooding, destroying communication systems and bridges. It also swept away some dwellings (United Nations Country Team, 2000). These natural hazards are likely to intensify and exert damage and destruction to existing infrastructure, thereby disrupting the supply chains in the country, resulting in a decline in dairy industry production and the subsequent collapse of some firms (Commercial Farmers' Union, 2010, p. 4; Government of Zimbabwe & United Nations, 2012, p. 6). Apart from natural disasters, Zimbabwe has to live with economic and political risks.

### **2.3. Economic risks in Zimbabwe**

The macro-economic environment's hostility continues to intensify and hinder agricultural growth. The dairy industry is naturally capital intensive, as a result, it is affected by lack of funding from the government (Hahlani & Garwi, 2014, p. 90). Anseeuw, Kapuya, and Saruchera (2012) noted that existing unfavourable borrowing conditions and limited access to agricultural finance are major factors in disrupting the supply chain. The procedure to be followed when obtaining finances for agricultural extension services is rather onerous and bureaucratic in nature (Hahlani & Garwi, 2014, p. 90). Restrictions stemming from borrowing procedures amplify the possibility of exposing dairy farmers to supply chain risks and disruptions. Dairy farmers receive small and irregular loan amounts, as a result, they cannot expand their dairy herds (Hahlani & Garwi, 2014, p. 90). The insecure land tenure system in Zimbabwe resulted in the reduction of investor confidence (World Bank, 1991 cited in Hahlani & Garwi, 2014). Zimbabwe's monetary policy statement issued in 2013 stated that bank loans and advances would remain largely short term, a situation that is not favourable to the dairy industry (Asian Development Bank & Asian Development Bank Institute, 2013). The problem still remains that the loan facilities are inadequate to suffice the whole agro sector, especially dairy farming which is capital intensive (Food & Agriculture Organisation [FAO], 2003). Many companies including those in the agro industry are having difficulties in funding their operations in terms of replacing old equipment, in order to enhance efficiency and competitiveness against imported products (Commercial Farmers Union, 2014). Furthermore, Zimbabwe dairy supply is also exposed to high labour costs. A study on the viability of small dairying in Wedza, indicated that increases in total variable and labour costs, reduced returns and income could not cover costs (Zvinorova, Halimani, Mano, & Ngongoni, 2013). In like manner Hahlani and Garwi (2014) alluded that dairy farmers faced high costs to breed or purchase cross breed heifers which become a dairy production constraint.

### **2.4. Political risks in Zimbabwe**

The current underperformance of the agricultural sector can be largely attributed to poor government policies and subsequent droughts. The political instability that was brought about by the land reform programme of year 2000, negatively affected dairy commercial farmers as most of them lost their farms (Mzumara, 2012, p. 41). After the launch of the land reform, cattle population dwindled, reflecting the retrogressive nature of the programme to the dairy sector (Anseeuw et al., 2012, p. 46). The land invasion and continued insecurity on the farms make it less conducive for dairy farmers to invest and expand their operations, resulting in milk quantity as well as quality significantly declining (Marecha, 2013, p. 14). This resulted in a total of 2,24,000 jobs lost on large-scale

commercial farms between 2000 and 2010 (Hawkins, 2013, p. 1). Land tenure and security of tenure, in which white commercial farmers are given five year leases, is not conducive for dairy farmers to invest in and expand their operations (Marecha, 2013, p. 14). Zimbabwe Human Rights NGOs Forum (2010, p. 5) postulates that the government's continued disregard of court rulings on land rights has negatively impacted on the agricultural sector. This reflects the government's unwillingness to provide a favourable environment for agricultural activities. The Government policies are inadequate and unfavourable to the dairy farmers. In areas where policies are in place, they are poorly and unfairly implemented due to political intrusion (Mudimu, 2003, p. 5). In the background of the economic and political situation obtaining in the country, there is a demand for studies on how disaster risks affect dairy supply chain performance. Though Zimbabwe has experienced many disasters since attaining its independence in 1980 with widespread impacts, previous researches have generalised on the presence of these disasters in the economy, not streamlining the existence and impact of these disasters in the dairy industry. It is to the best of these researchers' knowledge that no single research have been done to address these risks in the dairy sector in the country. In the light of the literature gathered on the impact of disaster risks, in addition to the political and economic situation in Zimbabwe, the following hypothesis was made.

Hypothesis: disaster risks negatively affected the performance of dairy supply chains in Zimbabwe.

### 3. Methodology

This article used a mixed method approach which employs both quantitative and qualitative methods. The mixed research method combined the best of both positivist and interpretivist paradigms, thus overcoming the weaknesses of each (Creswell, 2014, p. 17). The article data gathering combined administering 92 questionnaires (Appendix 1) on dairy farmers and interviewing (see Appendix 2 for the interview guide) 18 dairy officers and 30 retailers. Non-participant observations were made to dairy supply chain network, as it was quick to gather data and enabled the researchers to concentrate on observing, leaving less chances of missing some behaviour (Walliman, 2011). The questionnaire and interview guides design processes started with literature review and survey of similar research topics, to identify the concepts required (Saunders, Lewis, & Thornhill, 2009, p. 366). Informal and formal consultation with experts were conducted to translate the concepts into observable variables (Saunders et al., 2009, p. 367). The concepts under consideration were found as disaster risks and dairy supply chain performance (Factory Mutual Insurance Company, 2014, p. 4). The indicators of dairy supply chain performance were found as job losses, food insecurity, growth of firms, and reduced milk productivity (Commercial Farmers' Union, 2010, p. 4; Government of Zimbabwe & United Nations, 2012, p. 6; Hawkins, 2013, p. 1; Manyeruke et al., 2013, p. 271). The disaster risks in dairy supply chain in Zimbabwe were identified. For the structured questionnaire, the researchers' targeted population comprised 122 dairy farmers and milk processors in Zimbabwe. The respondent farmers and milk processors were located around the major milk producing cities/towns around Zimbabwe, to include Chipinge, Mutare, Harare, Gweru and Bulawayo. In depth interviews with purposively sampled dairy officers and retailers were also conducted (Sekaran & Bougie, 2009, p. 285). Cronbach Alpha test was conducted to test the reliability of the questionnaire and the value of 0.76 obtained confirmed reliability of the research instrument, as co-efficiencies greater than or equals to 0.70 are considered appropriate (Ciudad-Gómez & Valverde-Berrococo, 2014, pp. 83–88; Sekaran & Bougie, 2009). A pilot study was conducted to test for content and face validity (Saunders et al., 2009, p. 146). The pilot study also allowed corrections on ambiguous questions and adjustments to issues raised by the respondents. Permission was granted by the Department of Livestock Production and Development to carry out this study. Consent was also sought from participants for them to participate in this study without coercion, manipulation, or undue inducements, as they signed voluntary consent forms (European Commission, 2010, p. 40; Sekaran & Bougie, 2009, p. 260; Walliman, 2011, p. 43). The information given by participants was treated as confidential, to guard their privacy (Sekaran & Bougie, 2009, p. 260). Questionnaire data was analysed using STATA (version 13). Inferential statistics were used to measure the impact of disaster risks in Zimbabwe's dairy supply chains. This article tested for an overall effect of disaster risk index on job losses, food

security, depletion of dairy herd, hindered growth of dairy firms and quantity as well as quality of milk using Ordinary Least Square analysis. The overall disaster risk index was calculated by summing 14 disaster risks that are interest rates, influence from local giants, international competition, government policy, political influence, drought, cattle diseases, cyclones, extreme cold weather, feeds processing technology, power outages, milk technology, high labour costs and cost of breeding dairy herd. The summed Likert scale data was then analysed as interval data. Parametric statistics was used with Likert data without fear of coming to the wrong conclusion (Norman, 2010). Qualitative data collected from in-depth interviews with retailers and dairy officers was analysed according to themes and patterns emerging from the objective of this study.

#### 4. Results and discussion

##### 4.1. Demographics

The demographic data characteristics (age, gender, educational qualification, location, role assumed and experience in the dairy industry) from the questionnaire respondents are presented in Table 1.

This study revealed that there are fewer female dairy farmers and processors with only 15.19% of the total questionnaire respondents, while the majority (84.81%) were males, as shown in Table 1. This result concurs with the findings by Schaper, Lassen, and Theuvsen (2009, p. 6) in a study of five European countries on risk management strategies in which 95.7% of the interviewees were males, a clear indication of a male dominated dairy industry. It is evident from this study that the majority of the respondents (41.77%) fall within the 51 to 60 years age category as shown in Table 1. This is supported by Mudimu (2003, p. 5), who postulates that Zimbabwe’s land reform programme benefited mainly veterans of the liberation struggle, whose low educational qualifications and lack of proper farming experience negatively impacted on the dairy farming. However it can be deduced from the study that there is an acceptable level of literacy among the dairy farming community as all the dairy farmers and milk processors have attained at least primary level, the basic compulsory

**Table 1. Demographic data**

Biographical data	Variable	Frequency	Percentage
Gender	Male	67	84.81
	Female	12	15.19
Age	31 ≤ Age ≤ 40	8	10.13
	41 ≤ Age ≤ 50	12	15.19
	51 ≤ Age ≤ 60	33	41.77
	Age ≥ 61	26	32.91
Level of education	Ordinary level	14	17.72
	Diploma	47	59.49
	Degree	12	15.19
	Postgraduate	6	7.59
Region	Chipinga	9	11.39
	Gweru	18	22.78
	Harare	25	31.65
	Bulawayo	17	21.52
	Mutare	10	12.66
Experience	0 ≤ Experience ≤ 5	7	8.86
	6 ≤ Experience ≤ 10	38	48.10
	11 ≤ Experience ≤ 15	22	27.85
	Experience ≥ 16	12	15.19

Source: author.

level of education in the country (Stichting Nederlandse Vrijwilligers [SNV], 2013, p. 16). This study showed that the majority of dairy farmers and milk processors (31.65%) are in Harare region, bordering the capital city of Zimbabwe. In terms of dairy farming experience, Table 1 shows a relatively high number of inexperienced farmers with only 15.19% having been in this business for at least 16 years. This finding is supported by Zimbabwe Human Rights NGOs Forum's (2010, p. 1) view that Zimbabwe's land reform programme of year 2000 provided an uncondusive environment to the experienced farmers. During the land invasions that characterised the land reform programme, most experienced white commercial farmers lost their jobs as they were evicted from their farms, leading to a further decline in both food security and productivity in the diary sector.

#### 4.2. Impact of disaster risks on dairy supply chain performance

Multiple linear regression analyses were used to develop models for predicting the impact of an overall disaster risk index on four proxies of dairy supply chain performance (job losses, food security, hindrance to business growth and milk productivity). The overall disaster risk index summed up 14 disaster risks that included interest rates, influence from local giants, international competition, government policy, political influence, drought, cattle diseases, cyclones, extreme cold weather, feeds processing technology, power outages, milk technology and high labour and dairy breeding costs. The variables of gender, age, level of education, experience in dairy farming and location of dairy farm are included as controls. Discussed below are the questionnaire results, presented in Table 2, and the thematic results of the interviews held with key informants.

**Table 2. OLS estimates: Impact of disaster risks on job losses, food security, hindrance growth and milk productivity**

Variables	(1) Job loss	(2) Food insecurity	(3) Hindered growth	(4) Reduced Productivity
Disaster risks	0.0797* (0.0409)	0.0903** (0.0375)	0.0525** (0.0252)	0.0413* (0.0247)
Gender	0.133 (0.151)	0.337 (0.205)	0.330*** (0.102)	-0.00752 (0.169)
Age	-0.104 (0.0627)	-0.114 (0.0689)	0.0147 (0.0519)	-0.0438 (0.0520)
Level of education	-0.112 (0.0851)	-0.130 (0.100)	-0.0659 (0.0860)	0.0520 (0.0724)
Experience	-0.0695 (0.0735)	0.0697 (0.0861)	-0.0359 (0.0773)	-0.156** (0.0589)
Chipinge	-0.103 (0.168)	0.188 (0.176)	-0.0126 (0.220)	-0.366** (0.156)
Gweru	0.0879 (0.204)	0.391** (0.188)	0.0340 (0.201)	-0.151 (0.180)
Harare	0.416 (0.320)	0.731** (0.290)	0.327 (0.258)	0.0776 (0.236)
Bulawayo	0.0850 (0.214)	-0.00265 (0.200)	0.0540 (0.206)	-0.0428 (0.190)
Constant	1.450 (1.810)	0.308 (1.749)	1.731 (1.203)	2.999** (1.159)
Observations	77	77	77	77
R <sup>2</sup>	0.237	0.214	0.168	0.214

Note: Robust standard errors in parentheses.

\* $p < 0.1$ .

\*\* $p < 0.05$ .

\*\*\* $p < 0.01$ .

The study findings from both questionnaires and interviews revealed a significant impact of overall disaster risks on job losses, food security, hindered growth of dairy business and milk productivity. Increased incurrence of disaster risks resulted in increase in job losses in dairy supply chain, as indicated by a beta value of 0.0797\* presented in column 1 of Table 2. Interviews held with dairy authorities confirmed that droughts had negatively affected the dairy industry, with many employees on dairy farms and related industries losing their jobs, as dairy farmers discontinued production and dairy manufacturing plants closing down. They also attributed the loss of jobs to the political situation in the country. According to the Commercial Framers' union (2010) the hazards disrupt the supply chain in the country, leading to the collapse of some firms. The land reform programme alone resulted in a total of 2,24,000 jobs lost on farms between 2000 and 2010 (Hawkins, 2013, p. 1).

The article also confirmed that increase in disaster risks in dairy industry leads to food insecurity as shown by beta coefficient of 0.0903\*\* in column 2 of Table 2. Dairy officers and retailers interviewed confirmed that political and economic situations have left Zimbabwe food insecure. The food insecurity is accelerated as farmers are unwilling to engage in long term investments in dairy farming, owing to the short term leases offered to the white commercial farmers by the government. The article further established that droughts, veld fires and extreme weather conditions affected pastures as well as the overall milk yield from the different farming regions. Non-mechanization of some dairy farms and lack of proper inputs also negatively affected dairy herd sizes and consequently milk output declined. Hahlani and Garwi (2014, p. 93) concurs that dairy operations are affected by insecurity of land tenure. The study confirmed that dairy farmers faced dairy production constraints due to high costs in breeding or purchasing cross breed heifers, thereby failing to produce enough milk (Hahlani & Garwi, 2014, p. 90).

Results of this article also show that increased incidents and severity of disaster risks hinders growth of dairy business enterprises. A beta coefficient of 0.0525\*\* to hindered business growths variable as presented in column 3 of Table 2 confirms this. Interviewees blamed the droughts and extreme weather conditions for the growth failure in dairy business ventures. This concurs with the result of the Australian New Zealand Academy of Management (ANZAM, 2014, p. 13) where disaster risks in Bangladesh resulted in devastating losses to firms within the dairy supply chain. The findings concur with Manyeruke et al. (2013, p. 271) who argue that it is difficult to sustain viable agriculture when the most important natural resource, water, is depleted. According to The World Bank (2011b, p. 15), increased frequency and severity of drought has undermined milk production because of the lack of water and natural pastures.

Interviewees further alluded the failure in dairy supply chain firms to political risks such as the land reform programme of 2000, with most milk processors operating below full capacity due to inadequate delivery of raw milk from farmers. The poor performance is further precipitated by the unstable political and economic risks in the country. The unethical practices among political heavyweights as well as unfriendly government policies and legislations have taken its toll on dairy farming. The finding concurs with Rukuni (1994) cited in Anseeuw et al. (2012, p. 69) who postulates that over-centralisation of decision-making processes and lack of proper land reform programme coordination played a part in the failure of the agricultural sector, as political heavyweight could manipulate it in their favour.

In the same manner this article revealed that productivity was reduced as incidents and severity of disaster risks increased, as evidenced by the beta value of 0.0413\* presented in column 4 of Table 2. Interviewed dairy authorities further confirmed reduced productivity on dairy farms, placing the blame on droughts, land reform, and the general economic crunch facing the country. The prevailing economic liquidity crunch forced dairy farmers and producers to operate below normal capacity, leading to low milk output. This is confirmed by (Zimbabwe Vulnerability Assessment Committee [ZimVAC], 2009, p. 2) which argued that low productivity in Zimbabwe's dairy industry was the result of lack of capital investments, which in turn makes it difficult to employ productive farming technologies, leading to low yields. Hahlani and Garwi (2014, p. 90) also attest that the dairy industry is

naturally capital intensive, as evidenced by the huge amounts of money required to fully mechanise the industry for effective and sustainable productivity. The capital intense nature of the sector was not supported as both government and financial institutions were not putting in place favourable policies. This has in turn negatively affected the dairy supply chain. The study by The World Bank (2011b, p. 15) also agrees and explains how disaster risks lead to low productivity in other countries. Erratic power supply in Uganda caused significant problems, leading to long equipment breakdown time, idle capacity utilization, low-capacity utilization and high costs to supplement electricity (The World Bank, 2011b, p. 15).

## 5. Conclusions

The article concludes that disaster risks, which include natural disaster risks, political and economic meltdown in the country, have negatively impacted on dairy supply chain performance, as they have reduced productivity and negatively affected business growth. Through interviews with dairy authorities, this article established that droughts, veld fires, and extreme weather conditions are among the natural disasters that affected pastures, as well as the general milk yield. The impact of these disasters are evident as many people were jobless, pushing many families to a state of food insecurity. It is also noted that, the issue of unresolved land disputes between newly resettled farmers and former white commercial farmers greatly discouraged large-scale white commercial farmers from making long-term investment plans in growing dairy industry. The lack of experienced farmers and adequate funding hinder technological growth in the sector. Lack of up to date technology and input risks also negatively affected dairy herd sizes and consequently, milk output declined.

The article recommends the Division of Livestock Production and Development policies to recognize the important role played by the dwindling large scale commercial milk producers, with a view to encourage and support the revival of commercial dairy production. A lot of large commercial dairy farmers were affected by the land reform programme. Instead of the current maximum 5 year lease given to commercial farmers, the government should seriously consider issuing out long term leases in order to protect and promote long-term investment in dairy projects. There is political fabrication for political gains in the Zimbabwean agrarian reform agenda. The whole process of the land reform programme should be speedily concluded so that a clearly non-political land policy is implemented to promote production on dairy farms. Government should have deliberate policies that targets promotion of dairy farmers. To ensure that dairy stakeholders are not adversely affected by disaster risks, this study further recommends the establishment of comprehensive insurance policies for farmers. Establishing insurance policies targeting the industry will certainly transfer the risk to insurers. Very few dairy farmers have confirmed reliance on insurance, as insurance is seen as a luxury by many in the industry. There should be longer-term disaster risk reduction projects for sustainability of the dairy production. Adequate funding in disaster risk reduction programmes in most prevalent risks in different dairy regions is also recommended. These high risks should get funding for disaster risk reduction from government. Drought is one such disaster risk that affects most of the milking regions in the country. More funding should be directed towards construction of dams and boreholes to irrigate pastures and improve on milking parlours.

The researchers could have conducted a census by having respondents throughout the whole country. Due to resource constraints, the researchers could not access all the dairy farmers, dairy processors and retailers through a census hence resorted to sampling 92 dairy farmers, 18 dairy authorities and 30 retailers. The researchers recommend a comprehensive study that covers the whole country to give more insight into the impact of disaster risks on the performance of dairy supply chains in Zimbabwe. Thus, the findings from this research can be used to inform policy decisions to help improve the performance of dairy supply chain.

### Funding

The authors received no direct funding for this research.

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### Citation information

Cite this article as: An assessment of the impact of disaster risks on dairy supply chain performance in Zimbabwe, Felix Chari & Bethuel Sibongiseni Ngcamu, *Cogent Engineering* (2017), 4: 1409389.

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## Appendix 1

### Questionnaire

#### Section A: Demographic Data

##### 1. Gender

Male	01
Female	02

##### 2. How old are you?

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

##### 3. Level of Education

O Level	01
Diploma	02
Degree	03
Post Graduate	04

##### 4. Region located

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

##### 5. Experience in dairy farming

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

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

- 1- Strongly disagree
- 2- Disagree
- 3- Uncertain
- 4- Agree
- 5- Strongly agree

<b>SECTION B: Supply chain risks affecting dairy industry</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Uncertain</b>	<b>Agree</b>	<b>Strongly agree</b>
6. High interest rates	1	2	3	4	5
7. Local dairy giants flexing financial muscle	1	2	3	4	5
8. Unfair competition from foreign dairy brands	1	2	3	4	5
9. Government policy inconsistency in agricultural sector	1	2	3	4	5
10. Political interferences	1	2	3	4	5
11. Droughts	1	2	3	4	5
12. Cattle diseases	1	2	3	4	5
13. Cyclones	1	2	3	4	5
14. Extreme cold weather conditions	1	2	3	4	5
15. Food Processing facilities	1	2	3	4	5
16. Power outages	1	2	3	4	5
17. Milking machinery	1	2	3	4	5
18. High labour costs	1	2	3	4	5
19. High cost of breeding herd	1	2	3	4	5

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

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

## Appendix 2

### Interview schedule for dairy farming authorities

**Place of interview**

**Date of interview:**

#### Introduction

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

#### Questions

##### Section A: Demographics

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

##### Section B: Impact of disaster risks on dairy supply chain performance

4. How is the social a political framework of the country impacting on performance of the dairy industry?
5. How has the economic situation of the country affected the performance of the dairy industry?
6. Has the dairy industry in the region experienced any natural disaster?
7. To what extend have natural disaster impacted on the performance of the dairy industry?



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