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Knowledge Community as an Intervention Mechanism for Drought Resilience in South Africa

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Abstract: Drought remains an existential issue in South Africa, and it has posed significant threats to crop farming, pastoralism, and agriculture-allied industrial activities. This study, relying on structural-functionalism as theoretical thrust, examined the relevance of knowledge sharing and its receptivity to drought-affected actors at the municipal level. The study adopted survey method and drew 122 participants who are affected by or concerned with water stress for agricultural and agriculture-allied activities. The data collected were analysed using Chi Square (X2) statistical test and binomial regression. The findings of the study show that the participants believe that knowledge sharing at the municipal level among critical stakeholders will lessen the impacts of drought when it occurs. The participants also indicated that they are willing to be co-opted into such arrangement because of their belief that each stakeholder sector holds specialised knowledge and skills that may benefit other sectors and increase drought resilience. It is however important that the facilitation of the knowledge communities at municipal level be championed by the public and private sectors because of the financial implication of institutionalising such arrangement.

Keywords: community; drought; knowledge sharing; water stress; South Africa

JEL Classification: C1; C83; D8; Q54

1. Introduction

South Africa is an arid country and is one of the 30 driest countries in the world (Department of Water and Sanitation, 2022). The drought phenomenon in South Africa dates as far back as 400 years ago but its recognition as a serious natural disaster can be traced to early 20th century (Department of Water and Sanitation, 2022). The Republic of South Africa is a leading drought-affected country in the world today and it is known for dealing with recurring droughts and its attendant problems (Bahta &

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Myeki, 2021; Ibebuchi, 2021). According to South Africa's Department of Agriculture, Forestry and Fisheries' (DAFF) DAFF Draft National Drought Indaba Concept Note (2016), the 1923 final report of the Drought Investigating Commission remains a definitive publication on the subject. The great 27 droughts of the 1930s, which coincided with the Great Depression, have been the most talked about and remained the local drought benchmark for decades in South Africa. After the first known case of drought in South Africa in 1921, droughts have been a regular condition in the country but have been more noticeable and have had more impacts in certain periods than others (Camarero, Rozas & Olano, 2014). For instance, apart from the droughts of 1930s used referentially as severe droughts, there have been remarkable droughts in the 1980s, 1990s, and in recent times, 2005 and 2014/2015. In all these drought seasons, the predominantly rain-fed agricultural activities the country is known for have been severely affected. This is so because agriculture remains hugely sensitive to climate variations (Shiferaw, Tesfaye, Kassie, Abate, Prasanna & Menkir, 2014) and it is often affected by the vagaries of weather and climate (Gautam, 2006). The drought problem has had very devastating impacts on agriculture in South Africa. For instance, a total of 252,884 livestock loss was recorded in 2015 while over 9 million livestock were reported to be at risk because of drought (DAFF Draft National Drought Indaba Concept Note, 2016). South African government, like other national governments, has responded to the challenges posed by drought in a few ways. The 1996 Constitution of the Republic of South Africa (Act No.108) dictates that the management of water resources is an exclusive national competency. Government intervention began with the establishment of the National Drought Committee, which provided drought assistance schemes (Williams, 2016). A phased approach was taken to implement drought assistance schemes. Williams (2016) describes the first level of government assistance as discounts on transportation costs, advances, and subsidies at increasing rates. As a result of the drought assistance scheme, natural resources were protected, and assistance was provided to farmers during drought disasters. The drought assistance schemes were further acknowledged by the government, especially for their effectiveness in helping to sustain agricultural production.

While these efforts have proved reasonably effective, the impacts of drought on agricultural activities remain devastating in South Africa. This is because of the diminished capacity of farmers to produce crops and grow their livestock. It must also be noted that these interventions (primarily post-impact) which provide assistance without expecting recipients to change their behaviour or resource management practices create serious problems for vulnerability reduction (Wilhite, 2016). Monitoring and early warning signals (EWS) are key components of drought management, followed by vulnerability assessments and mitigation, preparedness, and responses (Funk & Shukla, 2020). This paper thus foregrounds the need for knowledge community that mobilises a cross-section of the individuals concerned with or affected by drought in a collective, knowledge-sharing relationship to control the impacts of drought when it occurs. This paper examined the relevance of knowledge community at the municipal level and the receptivity of affected stakeholders to it.

2. Literature Review

In this section, relevant literature bordering on the impacts of drought, drought vulnerability, drought drivers and other important nuances will be discussed.

2.1. El Niña and El Niño Phenomena

There are two climatic phenomena that have been found to determine the severity and intensity namely El Niño and La Niña (Jia, Cai, Gan, Wu & Di Lorenzo, 2021; Cook, Leslie, Parsons, & Schaefer, 2017). El Niño has been variously defined, yet it lacks a generally accepted definition (Vikas & Dwarakish, 2015; Dijkstra, 2006). El Niño is characterized by large-scale climatic interactions between ocean and atmosphere accompanied by episodic warmings in sea surface temperatures (SSTs) in the central and east-central Equatorial Pacific (Pandey, Misra & Yadav, 2019). Additionally, it is characterized by abnormally warm sea temperatures, strong southward coastal currents, high rainfall, and flooding in Ecuador and northern Peru (Philander, 1990). Regardless of the multiple views by its definers and the absence of consensus on its meaning, there is a common theme across the definitions which is that El Niño manifests in irregular warm waters at the ocean surface in the tropical pacific (Vikas & Dwarakish, 2015). While its origin is believed to be the tropical Pacific, its impacts on seasonal weather and climate's ecological, social, and environmental sectors globally (Vikas & Dwarakish, 2015; Singh, 2006; Jury, 2000).

Jiang and Fortenbery (2019) and Vikas and Dwarakish (2015) aver that El Niño occurs in every two to eight years, with the last being between 2015-2016 which occurred at the same time as the 2015/2016 drought in South Africa. El Niño is believed to be an important driver of drought that worsens drought episodes and makes them more severe in some parts of the world, including Southern Africa where it has been argued that most of the droughts the region has witnessed occurred in El Niño years (Fauchereau, Trzaska, Rouault, & Richard, 2003; Mason 2001). It has been argued that the 2005 drought that significantly impacted grape yield in Western Cape, South Africa was linked to the El Niño events (Camarero, Rozas & Olano, 2014). On the flipside, some other scholars have contended that there is no link between the water stress in the region and the El Niño phenomenon, arguing that that there are other normal, general circulations that may affect rainfall in Southern Africa other than ENSO (Manatsa, Nganai, Gadzirai & Behera, 2012; Manatsa & Matarira 2009; Blamey & Reason, 2007).

Conversely, the La Niña event refers to the episodic cooling of ocean sea surface temperature in the central and east-central equatorial pacific, with the ocean temperatures falling below the long-term average (Pandey et al., 2019; Jiang & Fortenbery, 2019; Singh, 2006; Jury, 2000). The La Niña phenomenon, which is believed to have a more severe impact than the ENSO, may last for up to three years, unlike the ENSO which usually lasts no more than a year. Overwhelmingly, there is a consensus that both the ENSO and La Niña have impacts on the global climate and may lead to the outset and/or worsen the severity of drought.

2.2. Drought Vulnerability and Impacts

The crux of drought vulnerability is the consideration of the socioeconomic, environmental, and atmospheric features that make a particular region prone to the vagaries of drought. According to Naumann, Barbosa, Garrote, Iglesias & Vogt (2013), there are a few factors that determine the extent of vulnerability to or exposure to the distressing impacts of drought namely land use pattern, population, technology, policy environment, social behaviour, water use, economic development, and diversity of economic system and cultural arrangement. These are critical to adaptation to drought when it occurs. Where there are no adequate structures, technologies, sound management and policy frameworks etc., drought vulnerability becomes severe (Naumann et al., 2013).

Drought particularly affects agriculture, especially rainfed agriculture and the resultant vulnerability varies from place to place based on a few factors. Hellmuth, Moorhead, Thomas, & Williams (2007) have also posited that factors such as the size of the farm – which may be influenced by customary and/or historical land tenure systems -, farming on marginal lands and knowledge of adaptive farming options, credit incentives for diversification options, local industrial activities for off-farm supplemental livelihood opportunities, and government policies may determine the degree to of drought vulnerability when it occurs. According to Turner, Matson, McCarthy, Corell, Christensen, Eckley & Tyler (2003), vulnerabilities to drought may be underlain by social issues such as confidence or lack of it in the new methods of doing agriculture, the costs such methods, and cultural belief.

2.3. Drought and the Economy

The impacts of drought on the economy, whether local or global, are well documented. Drought is part of the global natural disasters which impacts and costs on the economy have tripled over the years (Domeisen, 1995). In the 1960s, droughts accounted for US$40 billion in economic loss. In 2017, they accounted for US$127 billion in economic loss across the globe (Domeisen, 1995; UNCCD, 2022). In the 1990s, climatic events led to substantial spurt of economic loss with resultant costs extending to upward of US$400 billion through 1996 (Carolwicz, 1996). According to Wolchover (2014), in terms of impacts and severity of drought, drought is second to hurricane, which is a decisive problem with unimaginable costs lives and economies.

The drought costs to the economy may be looked at from non-structural losses and indirect and indirect or high-order losses. When drought leads to the reduction in the value of land or reduction or failure of crops and animal production, then the non-structural losses of drought are being experienced (Mysiak & Markandya, 2009). Conversely, the higher-order or indirect losses impact water-dependent sectors – agriculture, water navigation, hydroelectricity, manufacturing, and domestic water requirements (Benson & Clay, 2003). Drought leads to production cuts and rationalization, which impacts employment and livelihoods, and sets off a chain of reactions that affects every concerned sector (Mysiak & Markandya, 2009).

Drought poses significant threat to economic development in South Africa as it has always impacted agriculture, which is a top revenue earner for the country. A comparative study of the 2003 and 2004 drought impacts showed that wheat yield declined by 39%, the arable land for it shrank by 12%, and major dam water levels became 25% lower whilst other dams became completely empty (Theunissen, 2005). Drought is also responsible for the slowing down of and/or stunting of tree growth, thus reducing the contribution of forestry to the country's gross domestic product (GDP) (Jury, 2002). According to the SA Forestry (2022), the sector contributes about 25% percent of the country's agricultural GDP, 4.9% of the manufacturing GDP, and employs over 200 000 direct and indirect labour. Thus, drought not only affects the productive capacities of that sector but also the livelihoods of the sectors workers. The economic costs of droughts to agriculture, water-dependent and/or agriculture-allied industrial activities, and government – which provides relief assistance – are humongous (Baudoin, Vogel, Nortje & Naik, 2017; Ngaka, 2011).

3. Theoretical Framework: Structural Functionalism

This theory emanated in the main from the works of Emile Durkheim, Max Weber, Vilfredo Pareto, Alfred Raddiffe-Brown, Bronislaw Malinowski, and the British Economic theorist Alfred Marshall. However, the proponent of the theory who has had the vastest impacts on the theory is Talcott Parsons. His renown as the leading figure with regards to the theory since the 1950s drew 34 from his efforts towards explaining the basic functional requirements and structural patterns to be found in any social system, especially the overall society. The central theme upon which structural-functionalist approach was fabricated is organismic analysis. Early functionalists premised their conception of reality and social phenomena on organic model of life (Chilcott, 1998). In this model, the elements and constituents of an organism have specialised roles they perform to ensure the survival of the whole organism. This biological explanation was adopted to the explanation of society and social phenomena. Hence, society may be viewed as a system of mutually independent and, yet interdependent parts (Radcliffe-Brown, 1950). The theory is hinged on three major assumptions namely:

I. Functional unity: this presupposes role relationship among the different but related parts that make up any system.

II. Functionalism universalism: this means that the elements of any social system perform only positive functions; and

III. Functional indispensability: this refers to the functions performed by the elements of the social system as unique to the individual elements and can only be performed by them.

It must be stressed that the theory has been exposed to scathing criticisms which have weakened the wide acceptability it once enjoyed. The criticisms have also cast doubts on the theory's capability to explicate social realities. However, amidst the issues raised against the theory, it still has heuristic value till today. This is so especially as neo-functionalists such as Robert Merton and Lewis Coser have attempted to transcend earlier functionalists, particularly Parsons, by filling the gaps left unfilled by them. Having said that, it is noteworthy to mention that there is general agreement among the perspectives aligned with structural-functionalist theory about the roles that component elements of society or a social system play towards the survival of any given society or social system.

Structural functionalism is rooted in organismic conception of life which puts forward an argument that a society or social system is a sum of distinct but interrelated parts which function to sustain the whole. The key thrust from this theory especially as it concerns this study, which focuses on multi-level participatory process in drought management, is the desirability and importance of systemic cohesion and cooperation among different parts that make up any system. The applicability of this theory to this study stems from the belief that drought management, by virtue of the different stakeholders affected by or concerned with it, may be largely mitigated if these individuals share their unique skills and knowledge with one another towards controlling the impacts of drought when it occurs.

3. Study Setting

Kwa-Zulu Natal, formerly Natal, Province of South Africa, occupies the southeastern area of the country. On the north it is bounded by Swaziland and Mozambique, bounded on the east by the Indian Ocean, Eastern Cape Province on the south, bounded by Lesotho and Free State Province to the west, and finally to the northwest by

Mpumalanga Province. The Provincial capital is Pietermaritzburg. Below is the map of Kwa-Zulu Natal Provinces containing areas where data were collected.

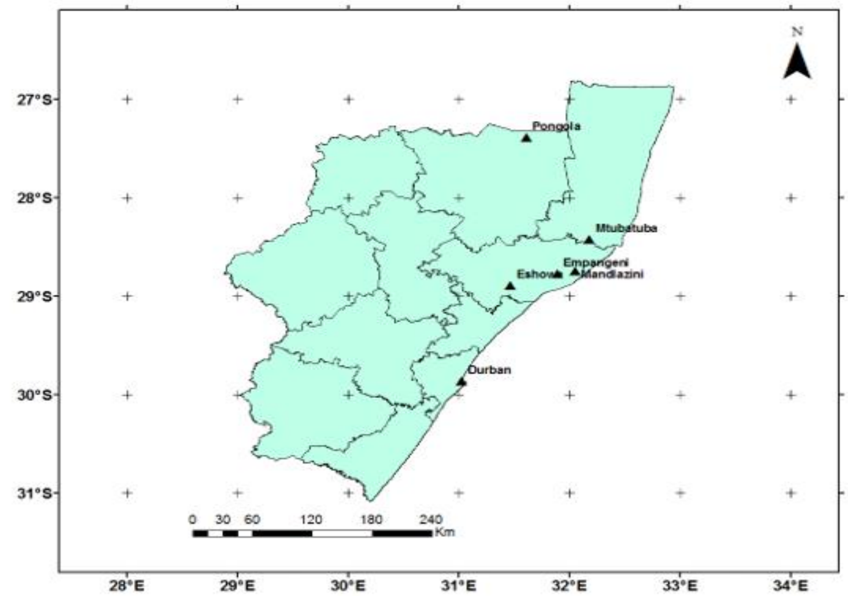

Figure 1. The map showing locations in KZN where data were collected for the study.

During the erstwhile racial segregation in South Africa, the apartheid regime, Kwa-Zulu Natal, then referred to as Natal Province, contained the non-independent Black State of Kwa-Zulu, which served as the legal homeland of the country's Zulu people. It was after the abolition of the apartheid and the reabsorption of Kwa-Zulu in 1994 that the province was renamed Kwa-Zulu Natal. A high hilly terrain dominates the province's geography, particularly along its western boundary (Encyclopaedia Britannica, 2020). In spite of the fact that the slope is not gradual, many rocky outcrops make the land appear as a series of steps that rise from 500 feet (150 meters) along the shoreline plain to 2,000 feet (600 meters) and then 4,000 feet (1,200 metres) in the middle of the Province, known as the Midlands, and beyond the Drakensberg lies the Highveld, or high plateau (Encyclopædia Britannica, 2020). Throughout the Province, the climate ranges from subtropical to temperate. On the coast, there are more than 50 inches (1,270 mm) of rain annually, whereas inland there is only 30 to 40 inches (760 to 1,020 mm) of rain (Eeley, Lawes & Piper, 1999). Although the temperature decreases from the frost-free coastal area, it remains warm. Generally, Southern Africa's coast is famous for its warm, dry, and sunny winters, while the summers are hot and often rainy. Also, during the winter, the Drakensberg has freezing temperatures and snowfall.

Kwa-Zulu-Natal is made up of different peoples belonging to various racial and/or ethnic groups. Black peoples, mostly Zulus, take up to more than four-fifths of the population, while Asians of mostly Indian descent take about one-tenth and whites of mostly European descent (Afrikaans) less than one-tenth (Encyclopædia Britannica, 2020; Haas, 1994). The settlement patterns in the extreme west and northeast of the province have a sparsely populated area; people are mostly concentrated along the coast. There is a high concentration of Black people in rural, broken, rugged terrain, while white people live primarily in Durban or coastal areas.

Kwa-Zulu Natal Province has quite a rich cultural diversity based on the social identities of the peoples that make up the province. By using their Zulu language and a rich tradition of folklore, ceremony, and custom reflecting a diversity of tribal allegiances, Black citizens have been able to retain and perpetuate their cultural identity. The rest of the Black Africans speak related Bantu languages while Afrikaans is spoken by white South Africans. South Africa's Asians are mostly concentrated in Kwa-Zulu-Natal Province, where more than half are Hindus and one-seventh are Muslims (Ziehl, 2002).

In the rural areas previously set apart for the Black population, subsistence economy holds sway as economic activity in these regions rests largely on livestock rearing and corn (maize) cultivation. It is supplemented by earnings from civil service, informal sector employment, and remittances from Blacks who work elsewhere in South Africa. White South Africans, on the other hand, tend to operate in an advanced commercial economy, leveraging on the natural resources the Province is endowed with and transforming them into finished, usable products (Robinson, 1990). In the north, around Newcastle and Dundee, coal is mined and has become a major source of cooking and semi-anthracite coal for South Africa (Encyclopaedia Britannica, 2020; Steenkamp & ClarkMostert, 2012). The Province's agricultural economy is based on animal and crop production, especially sugarcane which is the major crop. Kwa-Zulu Natal's crop production activities include the production of such subtropical fruits as pineapples and bananas, and the dairy industry (supported by the pastoral activities in the province) is also important. Plantations of pine and eucalyptus in the Midlands provide raw materials for sawmills and for paper and rayon pulp mills. Durban, as well as the neighbouring Pinetown, is the province's hub for economic and industrial activities and it has most of the province's factories and is one of South Africa's most important industrial regions. Most of the factories in Durban are primarily engaged in textiles and clothing, food processing, chemicals, sugar refining, and oil refining. The province also has a thriving and economically significant livestock farming industry. One of the reasons why the province was chosen is its strength as it concerns pastoralism. Pastoralism and/or cattle holding are symbolic in Zulu culture. Hammond-Tooke (2008) opined that for at least a thousand years, cattle have been the most cherished possession in Zulu and remain one of the few merchandises of real value owned outright by individuals and the only form of capital. The Zulus place a very high premium on cattle as they have used them in marriage exchanges that connect families and reinforce the legitimacy of the offspring produced from such marriages. Cattle have also proved quite pivotal in religious worship of ancestors by the Zulus and in entrenching chiefs' power (Hammond-Tooke; 2008). The period up to the end of the eighteenth century, according to Hammond-Tooke (2008), witnessed a steady growth in Zulu people's cattle holding, however there were periods of grave stock losses particularly during the great drought of 1804-1804 and the distressing rinderpest pandemic of 1896-97. Generally, however, cattle herding is a flourishing and respected vocation (MacKinnon, 1999). The prestige accorded cattle ownership is perhaps the reason why animal husbandry is a huge endeavour among the Zulu people and why it is made the preserve of males, seeing that patriarchal African structure will commit important and symbolic aspects of the culture to men (Sobania, 2002; Colvin, 1985).

4. Methods and Data

The study adopted a survey method for data collection. The population of the study covers farmers, herders, academics, civil society organisations interested in or concerned with the effects of drought on agriculture in KwaZulu-Natal Province, South Africa. A total of 122 respondents were selected for the study using both simple random sampling and purposive sampling. The purposive technique was used to complement the former technique because of the dispersion of the respondents across different sectors and locations.

The study employed a binomial logistic regression estimation technique to examine the role of knowledge community as an intervention mechanism for mitigating the impacts of drought on agricultural and agriculture-allied activities. Binomial logistic regression is used to predict the probability of the dependent variable (drought mitigation) which is dichotomous and dependent variables which can either be dichotomous or continuous. Mathematical representation of binomial logistic regression is given in Equation 1.

$$P(Y) = \frac{e^{\beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}{1 + e^{\beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}$$

where P is the probability of Y occurring?

e: is the natural log base.

β_0: is the intercept.

$\beta_1 - \beta_k$: regression coefficient

$X_1 - X_k$: independent/predictor variables

The question “the impact of drought can be mitigated” (DM) was used as dependent variable while the list of questions for independent variable (SCD, OSD, MKS, LFS, KCF, BSB, GPS, AGR and ADR) is given in Table 1. The study drew a total of 122 respondents from Kwa-Zulu Natal and Western Cape who participated in the survey. Furthermore, the study employed a chi-square test to examine the association between knowledge sharing and drought mitigation in South Africa.

Table 1. Variables Included in the Model.

Dependent variable	The impacts of drought can be mitigated	DM
Independent variables	People in my area of sector/professional background and other concerned people in other areas of sector/background share similar opinion about the cause(s) of drought or water stress for agricultural purposes	SCD
	Everyone (all the stakeholders including my sector) believes that drought’s impacts on agriculture are severe	OSD
	There is multi-level knowledge sharing among critical stakeholders in agriculture especially as it concerns water use and management	MKS
	There is a lot to be learned from other stakeholders concerned with drought and its dynamics	LFS
	There should be forums or knowledge community that allow for interaction among stakeholders on drought and water stress for agriculture	KCF
	Bringing every stakeholder on board for decision making and implementation of policies would lessen the impacts of drought on agriculture	BSB
	Government can pool all the stakeholders together for the purpose of managing drought	GPS
	Government has already done all it should do in incorporating all the stakeholders into the process of managing water stress for agriculture	AGR
	There is an adequate drought response in this province	ADR

5. Result and Discussion

The results of the Chi Square statistical test conducted on the answers provided by the respondents are provided in Table 2. The minimum expected cell frequency is 30.5. The statistical test at 139.180a also shows that the respondents believe that the impacts of drought on agriculture are severe. Agriculture is undoubtedly the most affected phenomenon as far as drought is concerned. Mostly, agriculture in South Africa is rain-fed. However, the test at 60.098a shows that the respondents believe that regardless of the vagaries of drought on agriculture, it can still be mitigated. This means that ways of reducing its impacts can be planned. At 46.066a, the test shows that the respondents generally believe that there is willingness of people within the stakeholder chain to share what they know about drought and its impacts on agriculture. This is pivotal to the effective management of drought and the issues it portends. Vogel and Olivier (2019) have argued that the identification and co-option of individuals whose knowledge of and skills about drought count is an important drought mitigation measure. The test at 20.361a (below the expected cell frequency) disproves the conjecture that there is multi-level knowledge sharing among critical stakeholders in agriculture especially as it concerns water use and management. There is also the perception of exclusion of stakeholders at 44.098a. This implies that the much-needed synergy that may help the reduce the impacts of drought is lacking. Conversely, at 41.475a, the test shows that the respondents believe that there is a lot that may be learned from each other as stakeholders. In the same vein, at 50.525a, the test shows that collaboration and integration among the stakeholders are pivotal to dealing with drought issue. There is need for cooperation among the relevant stakeholders relevant to agriculture and water issues (Roth et al., 2019).

Table 2. Chi Square Table

Test Statistics	Chi-Square	df	Asymp. Sig.
People in my sector are willing to share what we know about drought phenomenon and its mitigation with other stakeholders	46.066a	3	0.000
Everyone (all the stakeholders including my sector) believes that drought's impacts on agriculture are severe	139.180a	3	0.000
The impacts of drought can be mitigated	60.098a	3	0.000
People in my sector are willing to share what we know about drought phenomenon and its mitigation with other stakeholders	46.525a	3	0.000
There is multi-level knowledge sharing among critical stakeholders in agriculture especially as it concerns water use and management	20.361a	3	0.000
There is a lot to be learned from other stakeholders concerned with drought and its dynamics	41.475a	3	0.000
Every stakeholder sector has peculiar skills and knowledge that are relevant to dealing with drought phenomenon	43.705a	3	0.000
All the stakeholders must collaborate and integrate ideas to address drought problem	50.525a	3	0.000
There should be forums or knowledge community that allow for interaction among stakeholders on drought and water stress for agriculture	66.262a	3	0.000

Bringing every stakeholder on board for decision making and implementation of policies would lessen the impacts of drought on agriculture	70.197a	3	0.000
0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 30.5.			

The test shows that institutionalising knowledge community (at 66.262a) and joint decision- making and implementation on drought (at 70.197a) would lessen the impacts of drought. What these point to is the necessity of cooperation and multi-sectoral approach to drought. This will afford an opportunity for learning and broadening the understanding the phenomenon of drought. The multivariate logistic is presented in the following section.

5.1. Binomial Logistic Regression

The -2 Log likelihood, Cox & Snell R2 and Nagelkerke R2 values are presented in Table 2. The Cox & Snell R2 and Nagelkerke R2 are used to describe the variation in the dependent variable that is explained by the independent variable. In order word, it is useful in assessing the predictive strength of the logistic regression (Ilesanmi & Tewari, 2021)

The pseudo-R2 statistic is useful in assessing the predictive strength of the logistic regression model, i.e., the proportion of variance in the explained variable associated with the explanatory variables.

Table 3. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	101.083[a]	.086	.143
a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.			

From the result presented in Table 3, 8.6 percent and 14.3 percent variation in our dependent variable is explained by the independent variables depending on whether you reference the Cox & Snell R2 or Nagelkerke R2 methods, respectively. It is noteworthy that the Nagelkerke R2 is a modified test of Cox & Snell R2 therefore, it is more reliable. Thus, we can conclude that 14 percent probability of drought being mitigated is explained by the logistic model. Table 4 contains the classification results. The cut value is 0.500 as indicated in the subscript “a”.

Table 4. Classification Table

	Observed		Predicted		
			DV		Percentage Correct
			0	1	
Step 1	DV	0	98	3	97.0
		1	20	1	4.8
	Overall Percentage				81.1
a. The cut value is .500					

This implies that if the probability of a case being classified into the "yes" category is greater than 0.500, then that case is classified into the "yes" category. Otherwise, the case is classified as in the "no" category. With 97 percent correct classification, there is a high probability of drought being mitigated.

Table 5. Logistic Regression Coefficient

		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	SCD	-.398	.324	1.510	1	.219	.672	.356	1.267
	OSD	.375	.406	.851	1	.356	1.455	.656	3.225
	MKS	-.140	.251	.309	1	.578	.870	.531	1.423
	LFS	.718	.373	3.706	1	.054	2.050	.987	4.257
	KCF	-1.064	.474	5.036	1	.025	.345	.136	.874
	BSB	.278	.496	.314	1	.575	1.321	.499	3.493
	GPS	.549	.273	4.054	1	.044	1.731	1.015	2.954
	AGR	.253	.295	.738	1	.390	1.288	.723	2.297
	ADR	.126	.252	.252	1	.616	1.135	.692	1.860
	Constant	-3.380	1.706	3.926	1	.048	.034		
a. Variable(s) entered on step 1: SCD, OSD, MKS, LFS, KCF, BSB, GPS, AGR and ADR.									

The Wald test of the logistic regression coefficient is given in Table 5. The Wald test is used to determine the statistical significance for each of the independent variables and as well to test the contribution of each predictor in the model. The result indicates that KCF ($p = .025$), and GPS ($p = .044$) meets the 0.05 statistical level of significance while LFS ($p = .054$) is statistically significant at the 10 percent level of significance. The remaining predictors did not add significantly to the model.

We now turn to the odds (ExpB) column which allows us to predict the probability of an event occurring based on a one-unit change in an independent variable when all other independent variables are kept constant. The odds of the impacts of drought being mitigated are 0.345 greater when there are forums or knowledge community that allow for interaction among stakeholders on drought and water stress for agriculture compared to when there are no such forums. The inverse of the odds ratio equals 2.899.

This implies that there is a 2.899 times higher chance of the impact of drought not being mitigated when there are no forums or knowledge community that allow for interaction among stakeholders on drought and water stress for agriculture compared to when such forums exist. This is in line with the study of Wilhite (2016) who noted that drought policies should be geared towards knowledge sharing to prevent or mitigate the impact of drought rather than post-impact relief intervention. In order words, increasing drought preparedness through knowledge sharing should be an important element of national drought policy for building institutional capacity to cope with this prevalent natural disaster in a more effective manner (Wilhite, 2016).

Furthermore, result as presented in Table 5 indicate that the odds of the impact of drought being mitigated are 1.731 greater when government pools all the stakeholders together for the purpose of managing drought, though on the opposite direction compared to when there are forums or knowledge community that allow for interaction among stakeholders on drought and water stress for agriculture. The inverse of the odds ratio equals 0.578. This implies that there is a 0.578 times higher chance of the impact of drought not being mitigated when government does not pool all the stakeholders together for the purpose of managing drought, compared to when government pools all stakeholders together.

The odds of the impact of drought being mitigated are 2.050 greater when government learns from other stakeholders concerned with drought and its dynamics. Inverting this odds ratio for easier interpretation gives us a value of 0.488. This implies that there is a 0.488 times higher chance of the impact of drought not being mitigated when government does not government learn from other stakeholders concerned with drought and its dynamics. Invariably, there is a desirability of participatory resource governance as mediative mechanism in dealing with the phenomenon of drought. The test of goodness of fit is presented in Table 6. The Hosmer-Lemeshow (HL) test was used to check for the goodness of fit of the estimated model.

Table 6. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	8.238	8	.411

The decision rule is that if the p-value is less than 0.05, it means that the model is a poor fit. Although a p-value that is greater than 0.05 does not necessarily mean a good fit, it does imply that there is no evidence of a poor fit. The result as presented in Table 4 indicates that there is no evidence of poor fit. This is because the p-value (0.411) is greater than 0.05 mean.

6. Conclusion

This study has focused on the relevance of a mitigation plan that brings the different users or stakeholders in agricultural and agriculture-allied activities that are affected by drought in a knowledge-sharing platform at the municipal level. A logistic regression was performed to ascertain the relevance of knowledge community to drought mitigation when it occurs. The model explained 14% (Nagelkerke R2) of the variance in drought mitigation variable and correctly classified 97.0% of cases. Drought is 1.731 more likely to be mitigated if knowledge community that allows for interaction and knowledge sharing among stakeholders on water stress for agriculture and agriculture-allied is established at the municipal level. This, as evidenced in the results of the survey, will largely reduce the impacts of drought when it occurs. The data analysed through Chi Square statistical test also show the desirability of an inclusive arrangement that aggregates skills and knowledge across the stakeholder chain to deal with the issues consequent upon drought.

Fostering knowledge community at the municipal level may however be a herculean, if not an impossible, task without financial resources to facilitate it. This is where both public and private sector need to collaborate to provide the needed support that will aid knowledge sharing among the individuals affected by or concerned with drought. The cumulative effects of drought mitigation on the local economy will be seen in increased productivity by agricultural producers and productive efficiency of agriculture-allied industries. Lessening the impacts of drought because of knowledge sharing may not only affect agriculture-based employments at the municipal level, but it may also steady the agricultural producers' or workers' living standards. This is because the usual loss of crops and livestock often characterised with drought, will drastically reduce with an effective drought preparedness that a knowledge community involving critical stakeholders portends.

References

Bahta, Y. T. & Myeki, V. A. (2021). Adaptation, coping strategies and resilience of agricultural drought in South Africa: implication for the sustainability of livestock sector. *Heliyon*, 7(11), e08280.

Baudoin M. A.; Vogel, C. H.; Nortje K. & Naik, N. (2017). Living with drought in South Africa: lessons learnt from the recent El Nino period. *Int J Disaster Risk Reduct* 20, pp. 128–137.

Benson, C. & Clay, E. (2003). *Economic and financial impacts of natural disasters: an assessment of their effects and options for mitigation: synthesis report*. Overseas Development Institute, London.

Blamey, R. & Reason, C. J. C. (2007). Relationships between Antarctic sea-ice and South African winter rainfall. *Climate Research*, 33(2), pp. 183-193.

Britannica, T. Editors of Encyclopaedia (2 September, 2020). KwaZulu-Natal. *Encyclopedia Britannica.* https://www.britannica.com/place/KwaZulu-Natal.

Brown, J. (2011). Assuming too much? Participatory water resource governance in South Africa. *The Geographical Journal*, 177(2), pp. 171-185.

Camarero, J. J.; Rozas, V. & Olano, J. M. (2014). Minimum wood density of Juniperus thurifera is a robust proxy of spring water availability in a continental Mediterranean climate. *Journal of biogeography*, 41(6), pp. 1105-1114.

Carolwicz, M. (1996). *Natural hazards need not lead to natural disasters*. EOS 77, 16, pp. 149; 153.

Chilcott, J. H. (1998). Structural functionalism as a heuristic device. *Anthropology & education quarterly*, 29(1), pp. 103-111.

Colvin, P. M. (1985). Cattle sales in KwaZulu: A systems-based approach to an improved marketing strategy. *Development Southern Africa*, 2(3), pp. 383-397.

Cook, A. R.; Leslie, L. M.; Parsons, D. B. & Schaefer, J. T. (2017). The impact of El Niño– Southern Oscillation (ENSO) on winter and early spring US tornado outbreaks. *Journal of Applied Meteorology and Climatology*, 56(9), pp. 2455-2478.

Crausbay, S. D.; Ramirez, A. R.; Carter, S. L.; Cross, M. S.; Hall, K. R.; Bathke, D. J. & Dunham, J. B. (2017). Defining ecological drought for the twenty-first century. *Bulletin of the American Meteorological Society*, 98(12), pp. 2543-2550.

De Haas, M. & Zulu, P. (1994). Ethnicity and federalism: the case of KwaZulu/Natal. *Journal of Southern African Studies*, 20(3), pp. 433-446.

Department of Agriculture, Forestry and Fisheries (2016). *Draft National Drought Indaba Concept Note*. https://www.dalrrd.gov.za/doaDev/sideMenu/others/CCDM/docs/DAFF-CCDM%20Drought%20Indaba%20Concept%20Note%20-%2015%20to%2016%20September%202016.pdf (accessed on 15th August 2022).

Department of Water and Sanitation (2022). *Drought Interventions*. Available at: https://www.dws.gov.za/drought/default.aspx (accessed on 15th August 2022).

Dijkstra, H. A. (2006). The ENSO phenomenon: theory and mechanisms. *Advances in Geosciences*, 6, pp. 3-15.

Ding, Y.; Hayes, M. J. & Widhalm, M. (2011). *Measuring economic impacts of drought: A Disaster Risk Reduction*, 5, pp. 49-60.

Domeisen, N. (1995). *Disasters: Threat to social development*. STOP Disasters: The IDNDR.

Eeley, H. A.; Lawes, M. J. & Piper, S. E. (1999). The influence of climate change on the distribution of indigenous forest in KwaZulu-Natal, South Africa. *Journal of Biogeography*, 26(3), pp. 595-617.

Esikuri, E. E. (2005). *Mitigating drought-long-term planning to reduce vulnerability*, No. 37952, pp. 1-4. The World Bank.

Fauchereau, N.; Trzaska, S.; Rouault, M. & Richard, Y. (2003). Rainfall variability and changes in southern Africa during the 20th century in the global warming context. *Natural Hazards*, 29(2), pp. 139-154.

Funk, C. & Shukla, S. (2020). *Drought early warning and forecasting: theory and practice.* Elsevier.

Gautam, M. (2006). *Managing drought in sub-Saharan Africa: Policy perspectives*, No. 1004- 2016-78563).

Hammond-Tooke, W. D. (2008). *Cattle symbolism in Zulu culture*. Zulu identities: Being Zulu, past and present, pp. 62-68.

Hellmuth, M. E.; Moorhead, A.; Thomas, M. C. & Williams, J. (2007). *Climate risk management in Africa: Learning from practice*.

Hlalele, B. M.; Mokhatle, I. M. & Motlogeloa, R. T. (2016). Assessing economic impacts of agricultural drought: a case of Thaba Nchu, South Africa. *J Earth Sci Clim Change*, 7(327), p. 2.

Howitt, R. E.; MacEwan, D. & Medellín-Azuara, J. (2009). Economic impacts of reductions in delta exports on Central Valley agriculture. *Agriculture and Resource Economics Update*, 12(3), pp. 1-4.

Ibebuchi, C. C. (2021). Revisiting the 1992 severe drought episode in South Africa: the role of El Niño in the anomalies of atmospheric circulation types in Africa south of the equator. *Theoretical and Applied Climatology*, 146(1), pp. 723-740.

Ilesanmi, K. D. & Tewari, D. D. (2021). An Early Warning Signal (EWS) Model for Predicting Financial Crisis in Emerging African Economies. *International Journal of Financial Research*, 12(1), pp. 101-110.

Jiang, J. & Fortenbery, T. R. (2019). El Niño and La Niña induced volatility spillover effects in the US soybean and water equity markets. *Applied Economics*, 51(11), pp. 1133-1150.

Jury, M. R. (2002). Economic impacts of climate variability in South Africa and development of resource prediction models. *Journal of Applied Meteorology*, 41(1), pp. 46-55.

MacKinnon, A. S. (1999). The persistence of the cattle economy in Zululand, South Africa, 1900– 50. *Canadian Journal of African Studies/La Revue canadienne des études africaines*, 33(1), pp. 98-135.

Manatsa, D. & Matarira, C. H. (2009). Changing dependence of Zimbabwean rainfall variability on ENSO and the Indian Ocean dipole/zonal mode. *Theoretical and applied climatology*, 98(3-4), pp. 375-396.

Manatsa, D.; Unganai, L.; Gadzirai, C. & Behera, S. K. (2012). An innovative tailored seasonal rainfall forecasting production in Zimbabwe. *Natural hazards*, 64(2), pp. 1187-1207.

Mason S. J. (2001). El Nino, Climate change and Southern African Climate. *Environmetrics: The Journal of the International Environmetrics Society*, 12(4), pp. 327-345.

McCabe, G. J.; Betancourt, J. L.; Gray, S. T.; Palecki, M. A. & Hidalgo, H. G. (2008). Associations of multi-decadal sea-surface temperature variability with US drought. *Quaternary International*, 188(1), pp. 31-40.

Misra V (2003) The influence of Pacific SST variability on the precipitation over Southern monitoring. *Agricultural and Forest Meteorology*, 133(1-4), pp. 69-88.

Mysiak, J. & Markandya, A. (2009). *Economic costs of droughts*. Xerochore WP2 Brief.

Naumann, G.; Barbosa, P.; Garrote, L.; Iglesias, A.; Vogt, J. (2013). Exploring drought nexus. *International journal of environmental research and public health*, 13(4), p. 443.

Ngaka, M. J. (2011) Drought preparedness, impact and response: A case of Eastern Cape and Free State Provinces of South Africa. *J Disaster Risk Stud* 4: pp. 47-57.

Pandey, V., Misra, A. K., & Yadav, S. B. (2019). Impact of El-Nino and La-Nina on Indian Climate and Crop Production. In Climate Change and Agriculture in India: Impact and Adaptation, pp. 11-20). Springer, Cham.

Philander, S. G. (1990). *El Niño, La Niña, and the southern oscillation*, p. 293. San Diego, CA: Academic.

Radcliffe-Brown, A. R. (1950). Introduction. In Radcliffe-Brown, A. R. & Ford, D. (Eds.). *African Systems of Kinship and Marriage*. London: Oxford University Press.

Robinson, J. (1990). A Perfect System of Control'? State Power and 'Native Locations' in South Africa. *Environment and Planning D: Society and Space*, 8(2), pp. 135-162.

Rosegrant, M. W.; Cai, X. & Cline, S. A. (2002). *World water and food to 2025: dealing with scarcity.* Intl Food Policy Res Inst.

SA Forestry (2022). Forestry's Employment Contribution in South Africa. *Employment contribution Forestry South Africa Official Site*, accessed on 14th December 2022.

Salamia H.; Shahnooshib N. & Thomsonc, K. J. (2008). The economic impacts of drought on the economy of Iran: An integration of linear programming and macroeconometric modelling approaches. *Ecological Economics* 68, pp. 1032-1039.

Shiferaw, B.; Tesfaye, K.; Kassie, M.; Abate, T.; Prasanna, B. M. & Menkir, A. (2014). Managing vulnerability to drought and enhancing livelihood resilience in sub-Saharan Africa: Technological, institutional and policy options. *Weather and Climate Extremes*, 3, pp. 67-79.

Singh, M. (2006, November). Identifying and assessing drought hazard and risk in Africa. In *Regional Conference on Insurance and Reinsurance for Natural Catastrophe Risk in Africa*, Casablanca, Morocco.

Smith, C. (2018). *FIN24 Drought impact on W Cape economy worse than anticipated – minister*. https://www.fin24.com/Economy/drought-impact-on-w-cape-economy-worse-than-anticipated-minister-20180301 (accessed on January 2019).

Sobania, N. (2002). But where are the cattle? Popular images of Maasai and Zulu across the twentieth century. *Visual Anthropology*, 15(3-4), pp. 313-346.

Steenkamp, N. C. & Clark-Mostert, V. (2012, April). Impact of illegal mining at historic gold mine locations, Giyani Greenstone Belt area, South Africa. In *9th International Mining History Congress*, pp. 1-10.

Theunissen, P. (2005). *The economic impact of a drought*. From Retrieved on 27th February, 2019.

Turner, B. L.; Matson, P. A.; McCarthy, J. J.; Corell, R. W.; Christensen, L.; Eckley, N. & Tyler, N. (2003). Illustrating the coupled human–environment system for vulnerability analysis: three case studies. *Proceedings of the National Academy of Sciences*, 100(14), pp. 8080-8085.

UNCCD (2022, May). *Drought in numbers 2022: restoration for readiness and resilience.* Retrieved from https://www.unccd.int/resources/publications/drought-numbers.

Vikas, M. & Dwarakish, G. S. (2015) El Nino: A Review. *International Journal of Earth Sciences and Engineering*, Volume 08, No. 02, pp. 130-137.

Wilhite, D. A. (2016). Drought-management policies and preparedness plans: changing the paradigm from crisis to risk management. In *Land restoration*, pp. 443-462. Academic Press.

Williams, B. (2016). *Drought Policy in South Africa*. Water Crisis.

Ziehl, S. (2002). Black South Africans do live in nuclear family households—a response to Russell. *Society in Transition*, 33(1), pp. 26-49.