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Adoption of new technologies by exposing farmers to new information and technical skills

Jacobs Pienaar Makeba

Department of Geography, Environmental Management and Energy Studies, Faculty of Science, University of Johannesburg, South Africa.

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This paper investigated the role extension services plays in climate change adaptation in Limpopo province in South Africa. A representative sample of 300 farmers aged 16 to 65+ years (46% males and 54% females) participated in the study. The study involved Sekhukhune and Capricorn districts, with 56% farmers in Capricorn and 44% in Sekhukhune district. The following 10 local municipalities were visited: Elias Motsoaledi, Makhuduthamaga, Fetakgomo, Ephraim Mogale, Tubatse, Lepelle Nkumpi, Blouberg, Aganang, Polokwane, and Molemole. The research was analysed with software package for social scientists (SPSS). The following analyses were done: Descriptive analysis and Univariate analysis. The results showed that there is a great association among gender, employment, information of climate change, adaptation to climate change, information received through extension services, food scarcity, food security and agricultural production.

Key words: Climate variability, climate change, extension services, agricultural production, Limpopo province, South Africa.

INTRODUCTION

Climate change has become a very prominent issue in the media, international and national policy processes. The 4th Assessment Report of the International Panel on Climate Change (IPCC, 2007) summarized the expected impacts of climate change and served as a wake-up call for policy-makers and the public alike. The main projected future climate change are a continued rise in temperature (very likely greater than what was observed in the 20th century), increased incidence of heat waves and heavy precipitation events, decrease of rainfall in sub-tropical areas, rising sea levels and the increased likelihood that these aspects will develop in a non-linear and non-predictable manner (IPCC, 2007).

Universally, agricultural extension role in agricultural sector is educational. Extension officers are expected to provide and disseminate information to farmers. Other

services expected of extension officers, in their role and responsibilities, include providing institutional support and facilitating farmers needs to support agricultural production. Several models of extension exist in enabling extension services to be more client – oriented. In all of these models, government policy is considered important (Van Averbeke et al., 1998; Crookes, 2003). According to Igodan (1996), extension worker must be involved in monitoring and evaluation of the performance of farmers in development of projects.

According to IPCC (2011), agriculture is doubted the most important sector in the economies of most non-oil exporting African countries. It constitutes approximately 30% of Africans GDP and contributes about 50% of the total export value, with 70% of the continents population depending on the sector for their livelihoods (IPCC,

*Corresponding author: E-mail: Jacobs.makeba@gmail.com

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2011). Productions are subsistence in nature with a high dependence on the rain. The debate on climate change and its impacts on agriculture is therefore very crucial to every survival of the continent and its people. The continent is particularly susceptible in climate change because it includes some of the world's poorest nation (Chikaire et al., 2011). Agricultural extension has key role to play in initiating the change. This is because adaptations to climate change impacts require change in knowledge, attitudes, resilience capacities and skills of the people and agricultural extension can bring this change.

Agriculture is the mainstay of the Limpopo Province economy underpinning employment, food production and export. Agricultural and rural development is the focus for development strategies in Limpopo Province. In order for the agricultural sector to adapt against climate change, the provincial agriculture and extension policies and strategies are essential tools for this to be realised. For instance, UNFCCC (2008) found that farmers who had access to extension contact adopted farming technologies 72% greater than farmers who had no access to extension contact. Nhemachena (2008) also emphasised that exposure to extension services influences the capacity of farmers to adapt to climate change.

It should also be emphasised that agricultural extension enhances the efficiency of making adoption decisions. According to Adesina and Forson (1995) of the many sources of information available to farmers, agricultural extension is the most important for analyzing the adoption decision. Also, in the specific case of climate change adaptation, access to climate information may increase the likelihood of uptake of adaptation techniques.

According to FAO (2003), it has been observed that agricultural extension is involved in public information and education programs that could assist farmers in mitigating and mitigating the effects of climate change. According to FAO (2003), such involvements include awareness creation and knowledge brokerage on the issues of climate change; building resilience capacities among vulnerable individuals, communities and regions; encouragement of wide participation of all stakeholders in addressing climate change issues and developing appropriate framework for coping/adapting to climate change effects/impacts.

The paper hypothesized that access to extension services is positively related to adoption of new technologies by exposing farmers to new information and technical skills.

MATERIALS AND METHODS

This study used both quantitative and qualitative designs. Questionnaire which included matters relating to extension services, climate change and agricultural production was used in the interviews and focus group discussions was conducted after

face to face interviews with farmers. Permission was asked from the Limpopo department of agriculture to conduct research in their different local municipalities.

Univariate analysis model was used, which is able to demonstrate the relationship between dependent and independent variables as stated in the general equation below:

$$W_i = _ + _X_i + _j \quad (1)$$

W_i is the dependent variable value for person i

X_i is the independent variable value for person i

$_$ and $_$ are parameter values

$_j$ is the random error term

The parameter $_$ is called the intercept or the value of W when $X = 0$.

The parameter $_$ is called the slope or the change in W when X increases by one.

A representative sample of 300 farmers was interviewed. It was noted that 46% males and 54% females participated in the study. The study involved Sekhukhune and Capricorn districts (Table 1), with 56% farmers in Capricorn and 44% in Sekhukhune district. The following 10 local municipalities were visited; Elias Motsoaledi, Makhuduthamaga, Fetakgomo, Ephraim Mogale, Tubatse, Lepelle Nkumpi, Blouberg, Aganang, Polokwane, and Molemole (Table 1).

On the geographical locality of the study site, Limpopo province is situated in the northern part of South Africa. It is the gateway to the rest of Africa, with its shared borders making it favourably situated for economic cooperation with other parts of Southern Africa (StatsSA, 2011). Two districts were selected as the study areas, namely Greater Sekhukhune and Capricorn (Figure 1).

The selection was based on different agricultural setups and the different climatic conditions. For instances: (1) In Limpopo province, most areas are hot and some are also dry, increases in warming and declining precipitation are expected to have negative impacts on agricultural crop production (Sekhukhune District) and (2) In Limpopo province, there are districts that are experiencing dry and average wet conditions, this will result in increased seasonal rainfall and increased agricultural crop production (Capricorn District).

Purposive sampling technique was used to select three hundred farmers to be interviewed in order to cover uniformity and homogenous characteristics like rainfall patterns, skills availability, Access to information, Provision of agricultural training, level of temperature, Food scarcity, Unemployment and others. As part of standard protocol, a village meeting was conducted with all community representatives present: chiefs, indunas and local councillors of municipality before interviews. The nature of the research and the contents of the questionnaire were explained to them. The questionnaire covered both open and closed ended questions. Focus group discussion was conducted after face to face interviews with farmers. All farmers were invited for this focus group and the researcher used prepared climate change, agricultural production and extension service questions to facilitate discussions.

RESULTS AND DISCUSSION

The following 10 local municipalities were visited: *Elias Motsoaledi, Makhuduthamaga, Fetakgomo, Ephraim Mogale, Tubatse, Lepelle Nkumpi, Blouberg, Aganang, Polokwane, and Molemole* (Table 1). It was noted that 46% males and 54% females participated in the study. The study involved Sekhukhune and Capricorn districts

Table 1. Summary characteristics of sample in 10 local municipalities.

Variable	Total	Percentage
Number of farmers per district		
Capricorn	167	56
Sekhukhune	133	44
Number of Farmers per local municipality		
Aganang	26	8.7
Blouberg	16	5
Polokwane	31	10
Lepelle Nkumpi	51	17
Molemole	43	14.3
Greater Tubatse	22	7
Makhuduthamanga	20	6.7
Fetakgomo	31	10.3
Ephraim Mogale	52	19
Elias Motsoaledi	8	2.3
Sex of farmers		
Male	136	8.7
Female	164	5
Total	300	10

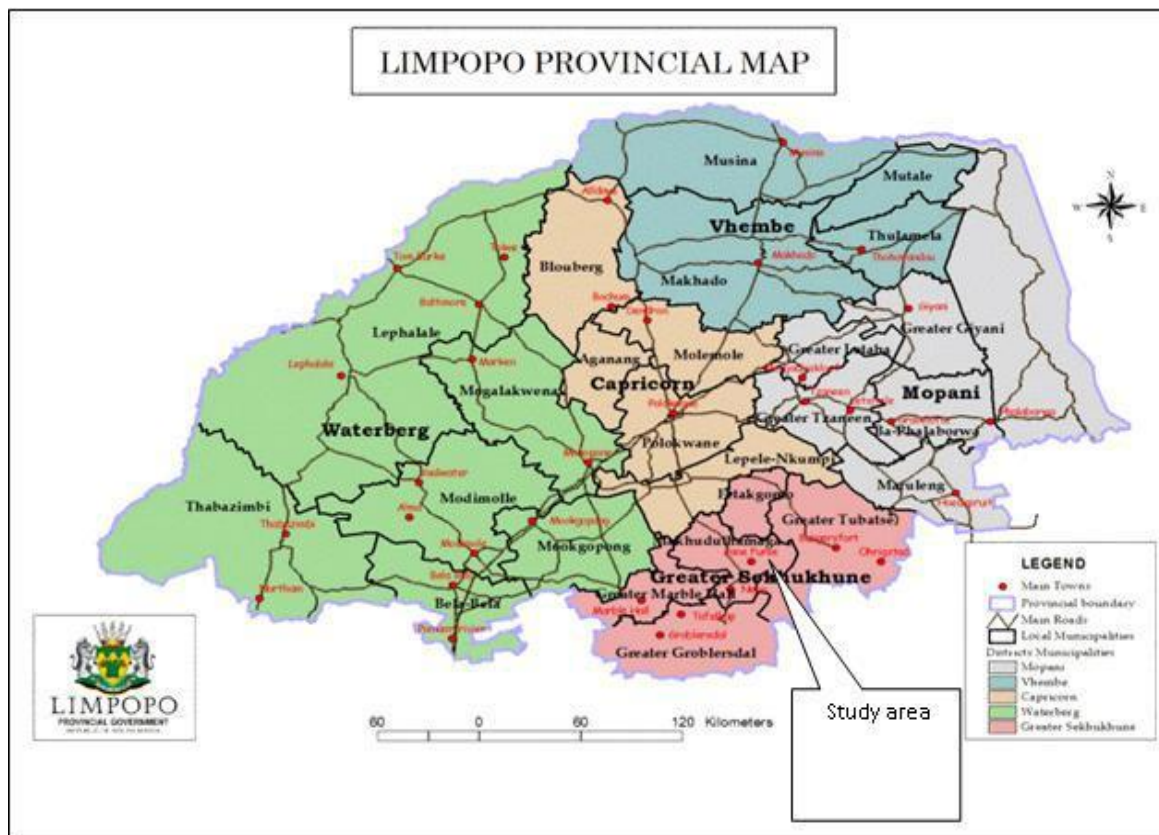


Figure 1. Geographic location of the Greater Sekhukhune and Capricorn Districts in Limpopo province. Source: StatsSA (2006).

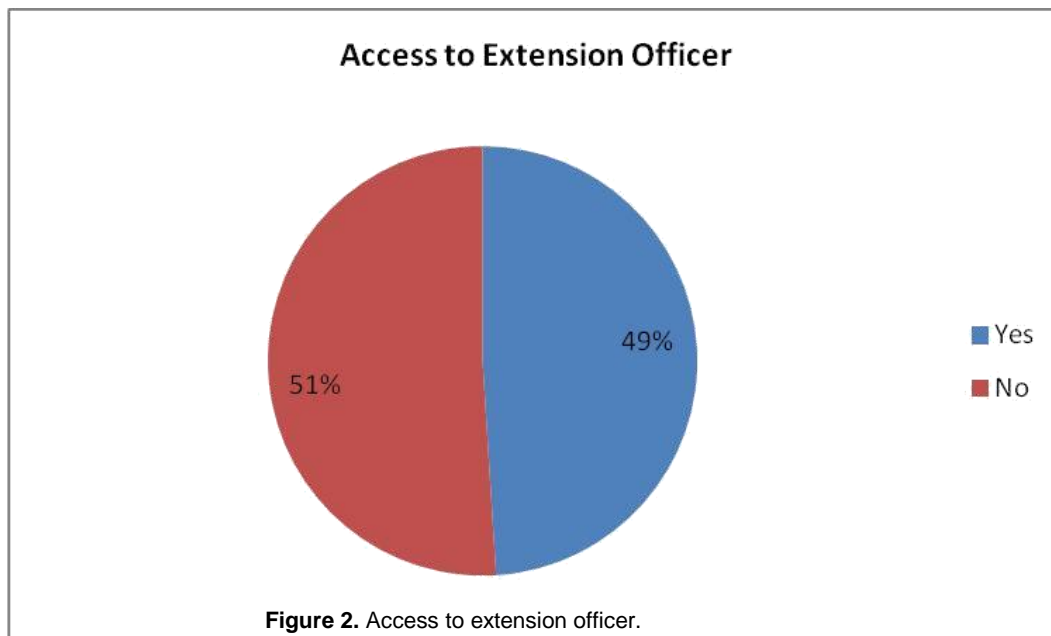


Table 2. Univariate analysis of potential determinants of agricultural product.

Variable	Total	Agric production (%)	OR (95%CI)
Information received through extension services			
Yes	146	4.1	2.45(1.585 – 12.697)
No	154	9.5	1

OR = Odds ratio; 95%CI = 95% confidence intervals.

(Table 1), with 56% farmers in Capricorn and 44% in Sekhukhune district. As indicated in Figure 2, extension services were received by only 49% of farmers. This is good because extension services enhance the efficiency of making adaptation decisions. Adesina and Forson (1995) further hypothesized that access to extension services is positively related to adoption of new technologies by exposing farmers to new information and technical skills.

According to IPCC (2011) climate change and its associated uncertainties implies that extension services need to regularly access new knowledge and extend it in an adequate and timely manner to the farmers. It also entails harnessing the local using the two sources of knowledge (extension and farmers) to improve adaptation practices. The low levels of education of some extension officers adversely affect the quality of extension services (Mmbengwa, 2009). Yet, to comprehend and communicate climate change, extension officers need regular training to upgrade their skills and be able to advice and work together with smallholders on how to adapt to climate change.

According to Table 2, the odds of being affected by climate change is 2.46 times higher for farmers that received information through extension services than those who did not receive information through extension services. This situation does not surprise me because some of the farmers especially resource poor farmers,

were complaining that some extension officers do not have relevant qualifications to do the job. Again some extension officers were also complaining that government is not organising relevant training courses that deal with climate variability and change and agricultural production. This is a clear indication that extension officers need to be re-trained in order to provide valuable information to the farmers so that farmers can value them. As Mmbengwa (2009) emphasised that extension services have an important role to play in assisting farmers to acquire new technology, skills, innovation and production advice. So Limpopo farmers and government should priorities extension service because it will significantly increase farmer awareness of changing climatic conditions as well as adaptation measures in agricultural production.

As seen in Table 3, the odds of unemployment as a result of climate variability and change are 0.32 less for farmers who receive information through extension services than those that do not receive information through extension services. This shows that extension services provide an important source of information for farmers and it increase their management, technical skills which farmers can use in other off – farm sectors. Farmers who received extension services can also train other neighbouring farmers regarding agricultural production and climate variability and change.

According to Table 4, the odds of farmers to face food

Table 3. Univariate analysis of potential determinants of Unemployment.

Variable	Total	Unemployment (%)	OR (95%CI)
Information received through extension services			
Yes	146	54.1	0.32(0.195 – 0.516)
No	154	27.2	1

OR = Odds ratio; 95%CI = 95% confidence intervals.

Table 4. Univariate analysis of potential determinants of food scarcity.

Variable	Total	Food scarcity (%)	OR (95%CI)
Information received through extension services			
Yes	146	17.8	0.95(0.517 – 1.730)
No	154	17	1

OR = Odds ratio; 95%CI = 95% confidence intervals.

Table 5. Univariate analysis of potential determinants of food prices.

Variable	Total	Food prices (%)	OR (95%CI)
Information received through extension services			
Yes	146	42.5	0.41(0.246 – 0.675)
No	154	23.1	1

OR = Odds ratio; 95%CI = 95% confidence intervals.

scarcity are 0.95 times less for farmers who receive information through extension services than those who do not receive information through extension services. This reflects the importance of extension services to avoid food scarcity. Through extension services, farmers can receive skills and knowledge to produce food. It was also supported by Mmbengwa (2009) who said farmers with access to extension services have better chance of engaging more profitably in agriculture than those that have no access. Table 5 results shows that extension services is very important to adapt against high food prices since the odds of being affected by high food prices as results of climate change are 0.41 times less for farmers who receive information through extension services than farmers who did not receive information through extension services.

SUMMARY AND CONCLUSION

The extreme weather patterns caused by climate variability and change in Limpopo province have impacted the farming communities severely for the past several years. The majority of these farmers have limited adaptive capacity, finance, technology and extension services to respond towards climate change challenges. These farming communities must recognise the role of

extension services as discussed in this paper and use the resources and information available to them to tackle climate variability and change. Adaptation to climate variability and change must become an important policy priority to the government and effectively be mainstreamed into national, provincial, local and sectoral development agendas (IPCC, 2011).

The role of agricultural extension officers should be further explained to the farming communities in Limpopo province. This must include Agricultural extension officers role in encouraging farmers to adopt new technologies, improved methods of farming, using a variety of methods to reach farmers that is, organizing study groups for farmers, farmer days, demonstrations, lectures and literature, as well as informing the media about farmers challenges. Designing policies that aim to improve role of extension services in communities have great potential to improve farmer adaptation to changes in climate as discussed in this paper. Government policies need to support the training of extension officers so that they give farming communities relevant information about climate change adaptation.

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