

Socio-Economic Determinants of Climate Change Awareness among Communal Farmers in Two Districts of Zimbabwe

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Abstract

Climate change poses a serious threat to agriculture-based livelihoods that farmers need to be made aware of. The study objectives of this article were to evaluate and determine socio-economic factors that have a significant impact on the level of climate change awareness amongst communal farmers in the Seke and Murewa districts of Zimbabwe. To this end, three hundred communal farmers were interviewed in 2011. The respondents had a broad awareness of climate change, though they had a limited understanding of the causes and global nature thereof, and of possible mitigating factors. Factors that were found to have a significant positive impact on climate change awareness were access to agricultural extension programmes and radio, a mobile phone and newspapers; age; level of education; participation in developmental and farmer organisations; and discussions about climate change. However, their position of authority had a significant negative impact.

Key words: climate change, awareness, information, determinants, ordered logit, rural farmers, Zimbabwe

Introduction

Agriculture forms the backbone of Zimbabwe's economy. This sector is highly dependent on the climate and weather patterns, though. Climate change is likely to compound the problems that

smallholder farmers currently face. For one thing, agricultural seasons will be affected, with negative consequences for agricultural production.¹ This necessitates that farmers adapt to climate change. At the individual level, having access to information about the impact of climate change and about one's vulnerability and how to adapt is a prerequisite to the farmer's improving his or her circumstances.² In other words, changes in behaviour are influenced to some extent by the information and knowledge that individuals have.

Successful adaptation depends on three elements: timely recognition of the need to adapt, an incentive to adapt, and the ability to adapt.^{3,4} Indeed, people have to know that there are solutions to the problem of climate change, and that they can be part of those solutions.⁵ This implies that to perceive and understand is a necessary condition for action, which includes adaptation. In the absence of information, one cannot formulate attitudes toward an issue, whether positive or negative in content.⁶ Similarly, only those farmers who perceive climate change will consider the need to adapt.^{7,8}

The need for awareness of and knowledge about climate change, and the general lack of this, is extensively emphasised in the literature.^{9,10,11} In order for rural people to successfully adapt to climate change and participate in its mitigation, they need information and knowledge about the various aspects of climate change. This includes information on its causes and effects, and on ways of responding to it. In this context, the objectives of this study were two-fold: first, to evaluate the level of climate change awareness amongst communal farmers in the Seke and Murewa districts of Zimbabwe; and second, to assess the determinants, or factors, that significantly influence climate change awareness in the two districts. Very few studies have taken such a focus, particularly in the African context.

Background to climate change response initiatives in Zimbabwe

Various initiatives are being undertaken by government, non-government, private and research organisations to enhance responses to climate change in Zimbabwe. The Ministry of Environment and Natural Resources Management (MENRM) is responsible for all environmental issues in the country, including climate change co-ordination through the Climate Change Office within the Ministry.¹² This is complemented by a multi-sectoral National Climate Change Committee (NCCC), which provides co-ordination advice and guidance in the implementation of various climate change programmes and projects.

In terms of policy, various steps have been taken to mainstream climate change into national programmes in Zimbabwe. Important milestones include the submission of national communications on climate change to the United Nations Framework Convention on Climate Change (UNFCCC). The first communication was submitted in 1998 and the second in 2013.¹³ However, the country currently has no specific policy on climate change.^{14,15} The government acknowledges this limitation; nevertheless, it argues that despite the lack of a standalone climate change policy, various policies and acts are in place to address climate change.¹⁶ A number of activities have been undertaken to enhance the generation, provision and dissemination of climate change information.¹⁷ These include climate change awareness workshops meant for the exchange of information on, and

the raising of awareness of, climate change among various stakeholders. Since 2006, more than 15 such workshops have been conducted.¹⁸ The primary aim of public awareness campaigns and workshops is to enable the public to participate in efforts to address climate change.¹⁹

Currently, efforts are underway to develop a National Climate Change Response Strategy and establish a National Task Team (NTT) on Climate Change.²⁰ The NTT will lead in the formulation of the Response Strategy and the National Climate Change Awareness and Communication Strategy. A very important initiative in addressing climate change in the country is the Coping with Drought and Climate Change Project. This project aims to enhance awareness and adaptation in the country with a particular focus on Chiredzi District. Other initiatives include the mainstreaming of climate change issues by civil society organisations such as the Zimbabwe Climate Change Youth Network.^{21,22}

Methods

The study was conducted in one of Zimbabwe's 10 provinces, Mashonaland East. The province has 11 districts, two of which were selected for the survey, namely Seke and Murewa. In 2002, Zimbabwe had a total population of some 11 634 663 people, and Mashonaland East province had a population of some 1 127 413 people and 309 198 households.²³ More than three-quarters of the population resided in rural areas, and agriculture was their main livelihood activity. Zimbabwe's climate is largely semi-arid, characterised by limited and unreliable rainfall patterns.²⁴ The two districts have climates associated with natural agro-ecological region II, with an average annual rainfall of 500–700 mm.

The data was collected in 2011, using a general survey of 300 farmers and interviewing key informants. The data covered aspects of climate change awareness, as well as socio-economic and information and communication technology (ICT) access variables. SPSS (version 17) was used for data entry and descriptive analysis, while STATA (version 12) was used for regression analysis. In brief, climate change awareness was evaluated as follows. First, the respondents were asked whether they were aware of climate change or had some knowledge thereof. Then the respondents who indicated that they were aware of climate change were asked to rate how strongly they agreed with each of the 11 formulated statements to assess their knowledge of climate change. These statements covered aspects related to causes, effects, adaptation and mitigation. The statements were rated according to a five-point Likert scale of 'strongly agree, agree, undecided, disagree, strongly disagree'. There are other studies that have used similar approaches.^{25,26}

It is important to note that the statements were general and less technical. Some of the rural people had not had a formal education, hence the survey was conducted in the local language, Shona. One of the challenges encountered in evaluating climate change awareness was how to operationalise English language terms such as 'carbon dioxide', as they do not have equivalent terms in the local language. Thus, in order for some of the respondents to be able to comprehend the statements, phenomena such as 'carbon dioxide emission' ended up being referred to as 'gaseous emissions' or 'pollution'. This tends to be problematic due to the application of wrong mental models and cultural models in the person's understanding of climate change issues.^{27,28,29} In

addition, the terms 'climate variability' and 'climate change' were difficult to differentiate, as they imply the same meaning in Shona. Nonetheless, great effort was taken to train enumerators to properly administer the survey and avoid making ambiguous statements when it came to translation into the local language.

The responses to the Likert scale statements were checked for their internal consistency using Cronbach's alpha.^{30,31} Cronbach's alpha coefficient for the 11 statements was 0,82, which indicates a good internal consistency, hence the scale was reliable. The next major step was to formulate the climate change awareness index (CCAI). The scores from the 11 statements were added to get total scores ranging between -22 and 22, and these total scores were then divided by 22 to get an index between -1 and 1. Based on this index, respondents were then categorised into three categories, namely not aware (index ≤ 0); low awareness ($0 < \text{index} < 0,5$); and high awareness ($0,5 < \text{index} \leq 1$). This gave an ordered variable which was used as a dependent variable in the regression analysis.

An ordered multinomial logit regression model was used to evaluate the significant determinants of climate change awareness. The rationale for using an ordered multinomial logit regression model derived from a number of reasons. Firstly, when the dependent variable is ordinal or not continuous, the linear regression model is inappropriate.³² This implied that the linear or binary regression models were inappropriate models for the ordered dependent variable. In such a case, a multinomial model for ordered data is more applicable.³³ This model is more appropriate, parsimonious and sensible as it takes into account the ordering.³⁴ The ordered multinomial logit model has been applied in other studies as well.^{35,36}

Results

Assessment of climate change awareness

The majority of respondents in both districts indicated that they were aware of climate change, though Murewa had a greater percentage of respondents (94 per cent) than Seke (79 per cent). As outlined in the methods section, these respondents were then asked to rate how strongly they agreed with each of the 11 statements formulated to assess their knowledge on the causes, effects and mitigation of, and adaptation to, climate change. Respondents were generally expected to agree with 10 of the 11 statements. Figure 1 presents the percentages of those who were undecided or who disagreed with the statements in Seke, while Figure 2 presents the same in Murewa. However, one statement, 'Zimbabwe is the only country likely to experience climate change', is not included in the two graphs, as responses to this statement differed from those to other statements. Respondents were generally expected to disagree with this statement, because climate change is a global phenomenon and as such other countries are likely to be affected.

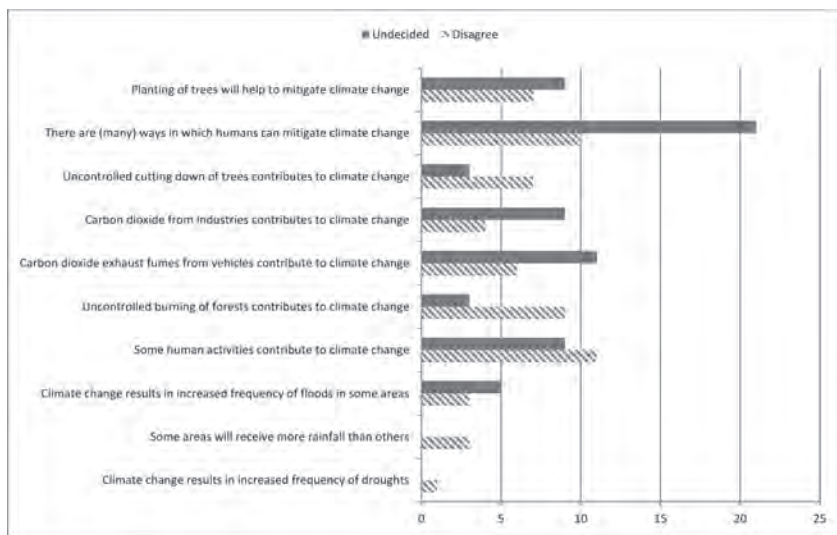


Figure 1 Percentage of respondents in Seke who either disagreed or were undecided

Figure 1 shows that in Seke, for six of the 11 statements (plus the one not in the graph), 5 per cent or more of the respondents (10 per cent or more for two of the statements) were undecided, though they had indicated that they were aware of climate change. The two statements on which 10 per cent or more of respondents were undecided are: ‘Exhaust fumes (carbon dioxide) from vehicles contribute to climate change’; and ‘There are (many) ways in which humans can mitigate climate change’. In addition, six of the 11 statements had 5 per cent or more of the respondents disagree (10 per cent or more for two of these), though in general they were expected to agree. The two statements with which 10 per cent or more of the respondents disagreed were: ‘Some human activities contribute to climate change’; and ‘There are (many) ways in which humans can mitigate climate change’. The statement ‘Zimbabwe is the only country likely to experience climate change’ had about 10 per cent of respondents agree, though they were expected to disagree with it.

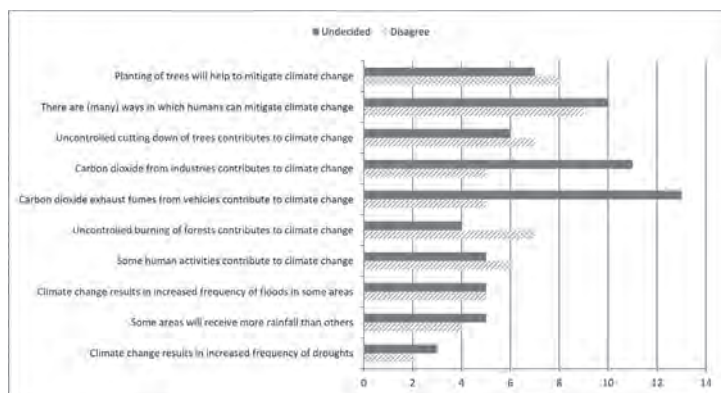


Figure 2 Percentage of respondents in Murewa who either disagreed or were undecided

Figure 2 shows that in Murewa, for eight of the 11 statements (plus one not included in the graph), 5 per cent or more of respondents (10 per cent or more for four of the statements) were undecided though they had indicated that they were aware of climate change. The four statements that 10 per cent or more of respondents were undecided on are: 'Zimbabwe is the only country likely to experience climate change'; 'Exhaust fumes (carbon dioxide) from vehicles contribute to climate change'; 'Emissions (carbon dioxide) from industries contribute to climate change'; and 'There are (many) ways in which humans can mitigate climate change'. In addition, eight of the 11 statements had 5 per cent or more of respondents disagree, though in general they were expected to agree. Whereas respondents were expected to disagree with the statement 'Zimbabwe is the only country likely to experience climate change', about 26 per cent of respondents actually agreed with it.

Calculation of the CCAI

As outlined in the methods section, a CCAI was formulated. The average CCAI for Seke is 0,48, while for Murewa it is 0,59. Based on the indices, respondents fell into three categories, namely not aware (index ≤ 0); low awareness ($0 \leq \text{index} \leq 0,5$); and high awareness ($0,5 \leq \text{index} \leq 1$). The output of the categorisation is presented in Figure 3.

It can be seen in Figure 3 that in the 'not aware' category, Seke had a greater proportion of respondents at 21 per cent, compared to 7 per cent for Murewa. In the 'low awareness' category, Murewa had a greater proportion of respondents at 29 per cent, compared to Seke's 19 per cent. In the 'high awareness' category, Murewa had a greater proportion of respondents at 65 per cent, as opposed to Seke's 60 per cent.

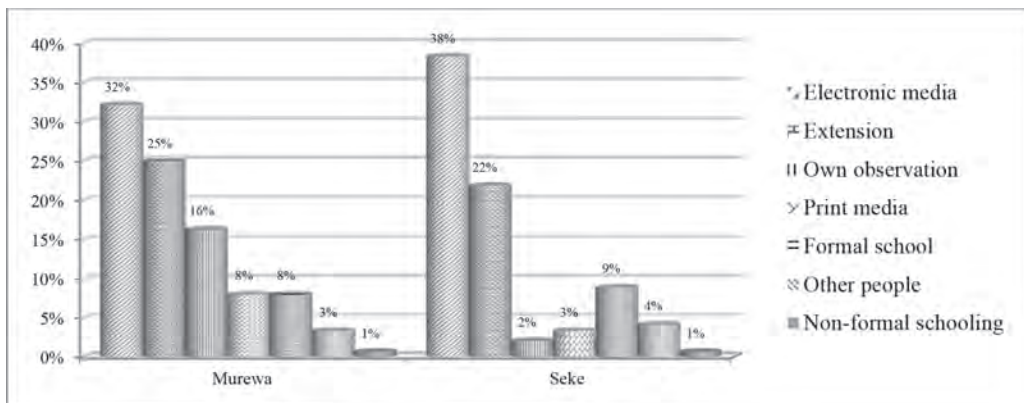


Figure 3 Categorisation of respondents according to level of climate change awareness

By and large, the key informants indicated that they were aware of climate change. They attributed the causes of climate change to the uncontrolled cutting down of trees, deforestation, industrial activity, the uncontrolled burning of forests and veld fires. In addition, some of them explained the causes in terms of spiritual and cultural beliefs, which also occurred in the case of respondents to the general survey. The key informants in Murewa indicated that, in general, people in the community (more than half) were aware of climate change. In Seke the key informants indicated that people in the community were aware of climate change, but their views were mixed (some estimated more than half of people were aware of it, while others estimated this figure at fewer than half).

Important sources of climate change information

About 86 per cent of respondents in Murewa and 79 per cent of respondents in Seke indicated that they had at one time or another talked about or discussed climate change with other people (family, friends, non-family, and non-friends). The reasons for the discussions were attributed to mere general comments about climate change as well as to the intention to learn from each other. Sources of climate change information included the electronic media, print media, extension programmes, the farmer's own observations, formal school, non-formal school, and other people. From these sources, respondents were asked to rank their most important source of climate change information. The results are presented in Figure 4.

Figure 4 shows clearly that the main sources of climate change information in both districts were pronounced to be electronic media, followed by extension programmes. In Murewa, these were then followed by the individual's own observations, the print media, and formal schooling. In Seke, the main sources were followed by formal schooling, other people, and the print media. The lowest-ranked source of climate change information in both districts was non-formal schooling.

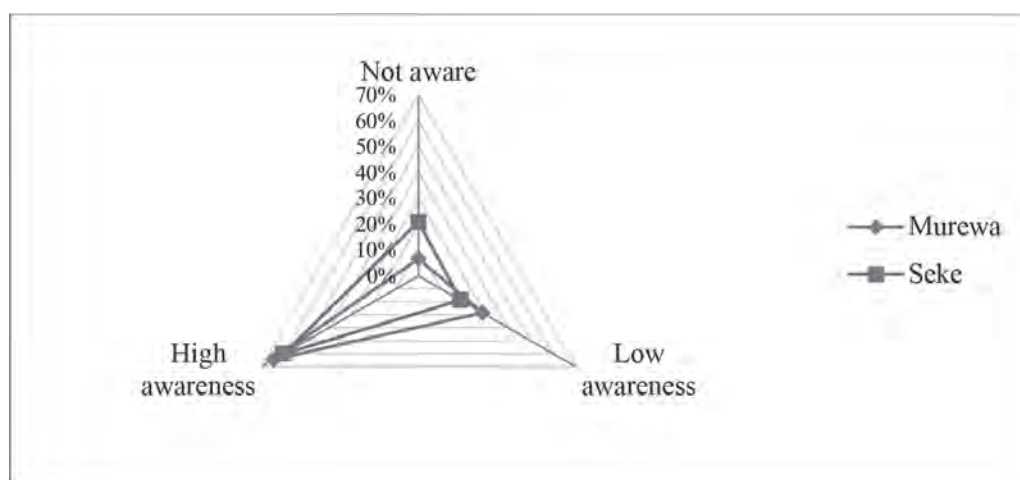


Figure 4 Ranking of sources of climate change information

Regression results on the determinants of climate change awareness

As described in the methods section, an ordered multinomial logit regression model was used to determine the socio-economic factors and ICT access variables (listed in Table 1) that had a significant impact on the level of climate change awareness. Three regression models were run concurrently: two for one each of the two districts, and the third one for the two districts combined. The output of each of the three models had p-values (Prob> chi2) of 0,000, which indicates that all three models are statistically significant. A summary of the models and the coefficients of the independent variables and their significance levels are presented in Table 1.

Table 1 Ordered logit regression model results

Model summary	Murewa model		Seke model		Combined model	
Log likelihood	-83,887263		-106,63421		-221,40891	
LR Chi2	69,54		54,48		76,01	
Pseudo R2	0,2930		0,2035		0,1465	
Prob> chi2	0,0000		0,0000		0,0000	
Independent variables	Coefficient and level of significance		Coefficient and level of significance		Coefficient and level of significance	
Gender	0,305		-0,697		-0,366	
Age	0,034	*	0,024		0,013	
Education level	-0,107		0,206	*	-0,013	
Land size	-0,011		-0,021		-0,002	
Agricultural income	0,024		0,054		0,268	
Access to extension programmes	2,211	*	0,245		0,971	
How cosmopolitan	-0,030		0,186		0,018	
Position of authority	-0,932	*	0,073		-0,407	
Participation in farmer organisations	-0,140		0,547	*	-0,024	
Participation in development organisations	-0,360		0,717	***	0,320	**
Access to radio	0,574		0,541		0,635	*
Access to TV	-0,001		-0,344		-0,064	
Access to mobile phone	1,829	***	-0,149		0,779	**
Access to newspapers	1,814	***	0,914	*	0,914	***
Access to farming/environmental magazines	-0,292		0,566		0,324	
Ever talked about climate change	4,075	***	1,299	**	1,710	***

Source: Survey data

Level of significance: * = 10 per cent; ** = 5 per cent; *** = 1 per cent

For the Murewa model, six independent variables were found to have a significant relationship with the level of climate change awareness. Five of these variables had a positive relationship, in line with a priori expectations. Three of these, namely access to a mobile phone, access to newspapers, and previous discussions about climate change were highly significant (1 per cent level), while access to extension programmes and the age of the respondent were significant at 10 per cent. However, one variable, namely position of authority, had a significant negative relationship (10 per cent level), contrary to a priori expectations. For the Seke model, five variables were found to have a significant positive relationship with the level of climate change awareness. The highly significant variables were participation in development organisations (1 per cent level) and previous discussions about climate change (5 per cent level), while education level, participation in farmer organisations, and access to newspapers were significant at 10 per cent. The positive relationships are in line with a priori expectations. When the districts were combined a number of variables were found to have a significant positive relationship with the level of climate change awareness. The highly significant variables at the 1 per cent level were access to newspapers and previous discussions about climate change, followed by participation in development organisations and access to a mobile phone at 5 per cent, and access to radio at 10 per cent. The positive relationships are in line with a priori expectations.

Discussion

The majority of respondents in both districts were found to be largely aware of climate change. The literature shows mixed results on the level of climate change awareness. Some studies and reports point to high awareness, whereas others indicate that there is low awareness. For instance, the ZBC reports³⁷ that the levels of climate change awareness are very high in Zimbabwe. Equally, Maddison³⁸ found a high perception of climate change among farmers in a study that was conducted in 11 African countries. Chagutah³⁹ states that many farmers are aware of climate change, though many view its effects in the context of normal seasonal climatic variability. Nevertheless, other studies and reports point to a generally low climate change awareness in Zimbabwe.^{40,41,42} The National Capacity Self-Assessment Study found low awareness of climate change, especially of its causes or possible redress mechanisms.⁴³ Likewise, the Gallup polls show that only 52 per cent of respondents in Zimbabwe had any knowledge of global warming.^{44,45}

Whereas the majority of respondents in this study were largely aware of climate change, the CCAI revealed that the respondents had varying levels of awareness. This implies that in some cases individuals might think they are aware of climate change when they actually have wrong information or perceptions about some of its aspects. To be specific, there was limited understanding of the issues relating to the causes and mitigation of climate change and, to some extent, its global nature. The literature corroborates this finding. For instance, a number of studies undertaken in Europe and the US show that despite widespread awareness of climate change, there was limited understanding of its causes and solutions to the problem.⁴⁶ Similarly, other studies confirm that the public have misconceptions about climate change.^{47,48} In Kiribati (a small island that is a developing state), Kuruppu and Liverman⁴⁹ found that though about 60 per cent of respondents

across the islands were aware of climate change, their understanding of climate science was weak. These studies show that a significant proportion of people do not have detailed knowledge of the topic, hence the need to distinguish between a genuine understanding of climate change and a superficial recognition of abstract terms.⁵⁰ Notwithstanding, over the years there has been a general and gradual increase in climate change awareness, particularly among farming communities. This increased awareness of climate change can be attributed to people observing and experiencing changes in weather patterns and extreme events.⁵¹ For instance, there was an increased awareness of climate impacts in southern Africa in the 1990s due to successive droughts, including the El Nino in 1997/1998, which elicited preparedness efforts and increased public attention.⁵²

The output from the regression models shows that a number of variables were found to have a significant positive relationship with climate change awareness. These are access to radio, access to a mobile phone, access to newspapers, age of the respondent, education level, participation in development organisations, participation in farmer organisations, access to extension programmes, and previous discussions about climate change. Position of authority had a significant negative relationship. Each of these variables is discussed in the paragraphs below.

The ICT and media-related variables, namely access to radio, access to a mobile phone, and access to newspapers, had a positive relationship with the level of climate change awareness. This corroborates the assertion⁵³ that emerging experiences in rural communities show evidence of the use of ICTs such as mobile phones and radio in facilitating the dissemination of climate change messages. These channels play an important role in promoting awareness or behaviour change.⁵⁴ Reid et al. note⁵⁵ that both the electronic and print media can play an important role in gathering and disseminating climate change information in Zimbabwe. Radio is widely diffused, hence it can reach the masses.⁵⁶ In addition, radio can reach illiterate farmers and provide them with information in a language they understand.⁵⁷ While these channels can provide farmers with climate change information, and researchers with field-level information, most importantly, they can facilitate communication between researchers and farmers.⁵⁸ A significant positive relationship was observed between access to a mobile phone and climate change awareness. In this context, the diffusion of the mobile phone creates opportunities for climate change adaptation, including capacity building, monitoring and information dissemination.⁵⁹ Mobile phones have much potential for use in information exchange, though it has to be determined which types of information should and could be effectively communicated.⁶⁰

It is important to note that climate change issues are covered in the Zimbabwean media, albeit not prominently. The coverage of such issues in the country's media remains low-key and subordinate to other societal concerns.⁶¹ Nevertheless, there have been efforts over the years to increase coverage. This includes the training of journalists on climate change reporting and advocacy, which has improved the number and quality of radio, television and written reports on climate change in the country.⁶² Furthermore, the country's proposed national climate change communication strategy includes the use of various media such as radio, television, videos, newspapers, magazines and chat shows.⁶³

In terms of personal attributes, the age of the respondent was found to have a significant positive relationship with the respondent's level of climate change awareness. In other words, older farmers were likely to be more aware of climate change than younger farmers. In this study,

age was used as a proxy for farming experience. This supports Maddison's finding⁶⁴ that farmers with more farming experience were more likely to perceive climate change. Similarly, Hassan and Nhemachena observe⁶⁵ that experienced farmers usually have better knowledge of and information on climate change. Likewise, Patt and Schröter argue⁶⁶ that perceptions about climate change grow out of a lifetime of experience. This could possibly be due to the fact that individuals observe changes in climate variables, which influences them to seek information and knowledge on why there are such changes.

Respondents' education levels were found to have a significant positive relationship with climate change awareness. More educated farmers were more likely to have more knowledge on various aspects of climate change. This finding supports the UNFCCC's observation⁶⁷ that education plays an important role in enhancing climate change awareness. Related to this finding, Maddison found⁶⁸ that educated farmers were more likely to respond to the problem and adopt at least one adaptation strategy. Though a positive relationship was observed, it is important to note that the current education curriculum in Zimbabwe is deficient in respect of climate change content.⁶⁹ Nevertheless, subjects such as social studies, environmental studies, agriculture, geography and civic education partly incorporate climate change issues.⁷⁰ The positive relationship could, however, be due, firstly, to the importance of education in understanding climate change content, which usually occurs in the English language. Secondly, having some education can help in understanding the technical relationships between causes, effects and response strategies.

Participation in farmer and development organisations was found to have a significant positive relationship with the level of climate change awareness. This finding supports the UNFCCC's observation⁷¹ that initial communications from member countries highlighted the important role that civil society, non-government organisations (NGOs) and church-based groups play in raising public awareness of climate change. In Zimbabwe, one notable example of NGOs mainstreaming climate change issues is the Zimbabwe Climate Change Youth Network.⁷² In addition, access to agricultural extension programmes was found to have a significant positive relationship with climate change awareness. In this regard, Maddison found⁷³ that farmers with access to extension advice were more likely to adapt to climate change. This is supported by the UNDP's assertion⁷⁴ that agricultural extension programmes help farmers respond to climate change and address some of the underlying issues.

The variable of previous discussions about climate change was found to have a significant positive relationship with the level of climate change awareness. The majority of respondents indicated that they had at one time or another talked about climate change. Likewise, Chaudhury et al. found⁷⁵ that the sharing of information on agricultural practices learnt from neighbouring villages was common and important within the household. Due to the importance of interpersonal communication it should be embraced in public education campaigns on climate change.⁷⁶

The variable of position of authority was found to have a significant negative relationship with the level of climate change awareness in Murewa, and a non-significant positive relationship in Seke. Respondents' position of authority is closely related to the role played by opinion leaders. Largely, opinion leaders have greater exposure to mass media, tend to be more cosmopolitan, and have greater change agent contact than their followers.⁷⁷ It is for these reasons that having a position of authority was expected to have a positive relationship. However, a possible reason for the

significant negative relationship could be that while positions of authority might be viewed as being closely related to opinion leadership, this might not necessarily apply to knowledge-related issues such as climate change. Some positions of authority are actually traditional and political, which does not translate into the likelihood of being knowledgeable about climate change. In the context of this study, successful farmers and local knowledge experts could be more knowledgeable and could be more appropriate opinion leaders.

Conclusion

Although the majority of respondents in both districts were generally found to be aware of climate change, some of those who perceived themselves as being aware were in fact not aware or had a low level of awareness. Broadly, the respondents had a limited understanding of the issues relating to the causes and mitigation of climate change and its global nature. There has been a notable increase in climate change awareness over the years, particularly amongst the farming community. Nonetheless, it is important to bear in mind that having information on and being aware of climate change does not easily translate into adaptation. This does provide an important basis for responsive action, though; hence the need to enhance the dissemination and transfer of climate change information and knowledge. In summary, the most significant channels for the transfer of climate change information comprised both old and new ICTs, and interpersonal channels. It can be deduced that their promotion and use should not favour one channel at the expense of another; rather, they should be embraced as complementary. In addition, the findings showed that, in the two districts, different variables had significant relationships with climate change awareness. Whereas the general norm is to generalise findings, these results actually suggest that generalisations might not be suitable in some cases. This is due to the fact that climate change issues tend to have area-specific impacts and interactions, such that generalising can result in a loss of important information. Thus, simply drawing lessons from such findings might be of paramount importance.

Initiatives to promote climate change awareness and adaptation should provide various platforms for the stakeholders to share and exchange information. In addition, the climate change information and messages should be transmitted in local languages which can be easily understood by illiterate individuals, while also ensuring that marginal groups have access to such information. Although this study found many variables had different relationships with climate change awareness, further in-depth analysis is required to explore and understand these relationships. Moreover, the study did not look at how access to climate change information actually translates into adaptation; hence, further research is required to clearly establish these relationships.

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