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Muchie, Mammo; Mudombi, Shakespear

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ANALYSIS OF THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) IN CLIMATE CHANGE AWARENESS IN SEKE AND MUREWA DISTRICTS OF ZIMBABWE

Shakespear Mudombi and Mammo Muchie

Institute for Economic Research on Innovation

Tshwane University of Technology

159 Skinner Street, Pretoria, 0001. South Africa

mudombi.shakespear@gmail.com muchiem@tut.ac.za

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ABSTRACT

The paper provides an analysis of the role of Information and Communication Technologies (ICTs) in contributing to climate change awareness in rural areas namely Seke and Murewa districts in Zimbabwe. The literature review showed that for successful adaptation and mitigation by individuals and communities, information and knowledge about the nature of the problem, its causes, its effects and possible solutions, are a prerequisite. Agricultural communities can get information from the traditional agricultural extension system, however due to various constraints to the extension system, ICTs have the potential to reach a wider audience including even those with no access to extension. Of importance is to package the climate and climate change information in an appropriate form, language and time and ensure it is credible, legitimate, and salient as highlighted by various authors. The paper is based on primary data whereby both quantitative and qualitative data collection methods were employed. The study found out that the majority of respondents are aware of climate change. Though there are many different sources of information, ICTs were found to significantly influence climate change awareness. ICTs such as the radio and mobile phone are likely to increase the odds of being aware of climate change. Reading Farming/Environmental magazines also had a significant influence on the odds of being aware of climate change. However a negative relationship was found between television ownership and the odds of climate change awareness.

1 INTRODUCTION

The purpose of the paper is to examine the importance and contribution of ICTs to rural people's awareness of climate change in Seke and Murewa districts in Mashonaland East Province in Zimbabwe. The paper is based on both secondary and primary data. A literature review is provided on: climate variability and change in general and then narrows down to the Zimbabwean perspective; the role of ICTs in development. It then provides a conceptual framework and the methods used to collect the primary data; then presents and discusses the results and concludes.

1.1 Background Information

Climate is recognised as one of the biggest risk factors affecting the performance and management of agricultural systems, and its variability and change contribute to the vulnerability of individuals, businesses, communities and regions (Meinke, et al. 2006). The

decline in rainfall and extreme weather patterns such as heavy rains, cyclones and droughts are becoming more frequent throughout the continent especially in Sub-Saharan Africa (IFAD, 2010). Agricultural production relies mainly on rainfall and will be severely compromised in many African countries, particularly for subsistence farmers; under climate change much agricultural land will be lost, with shorter growing seasons and lower yields (UNFCCC, 2007).

Cooper et al., (2008) noted that whilst the exact nature and extent of the impacts of climate change on temperature and rainfall distribution patterns remain uncertain, it is the poor and vulnerable who will be the most susceptible to changes in climate. Though these farmers have developed several adaptation options to cope with current climate variability, such adaptations may not be sufficient for future changes of climate (Boko, et al., 2007). Because of rural households' vulnerability to climate change, there is need to devise strategies and coping mechanisms that enhance rural households' capacity to adapt to and also participate in the mitigation of climate change. In order to strengthen farmers' capacity to adapt to climate change, it will be necessary to implement adaptation strategies through educating farmers with tested and proven methods (Ngigi, 2009). Awareness creation can strengthen farmers' capacity to adapt to climate change through sensitization of farmers and dissemination of climate change information (ibid).

There are various ways in which technologies both old and new can help in reducing the effects of climate change. ICTs can play an important role as a medium of information and communication in climate change awareness; adaptation and mitigation strategies. However the availability and adoption of ICTs is varied between areas: developed and developing countries; urban and rural areas and within rural areas themselves. Even when the ICTs are available the information that is transmitted is also varied and its reception is varied. Thioune (2003) noted that ICTs are known to transform communities, however the details of these transformations, the degree and pace of such changes are yet to be fully grasped, hence the link between development and use of ICTs are yet to be clearly established and supported by empirical results from Africa. Ospina & Heeks (2010) noted that experiences from vulnerable communities in Asia, Africa, Latin America and the Caribbean point to the use of ICT applications as part of climate change responses, however, this constitutes a very new field of enquiry where much remains to be explored. Hence the need for such studies, to explore the level of climate change awareness and how ICTs contribute to this awareness amongst rural households.

1.2 Objectives of the research

The main objective of the study was to analyse the level of climate change awareness amongst rural people in Seke and Murewa districts of Zimbabwe, and how information and communication technologies (ICTs) contribute to climate change awareness in these two districts.

2 LITERATURE REVIEW

Ospina and Heeks (2010) in the scoping study on the links between ICTs and climate change in developing countries noted that literature linking both the potential and challenges of ICTs in the climate change field began to emerge at the beginning of the 2000s; they identify three distinctive strands of research in the field. The first strand of research addresses broad issues concerning ICTs, sustainable development and the environment from a global perspective. The second strand is characterized by the emergence of more topic-specific and technical research covering aspects of climate change mitigation, and driven primarily by developed

countries' priorities in the field. The third strand is characterized by an increasing acknowledgement of developing countries' needs and priorities in the climate change field. This strand is characterized by emerging evidence on the use of ICT applications in vulnerable contexts and adaptation strategies of developing countries (ibid). It is the third strand that will be the focus of this paper.

2.1 Climate variability and change in Zimbabwe

Climate change leads to variations in the amount of rainfall received, with some regions experiencing too much rainfall which might result in floods while other areas receive less and inconsistent rainfall, which might result in droughts (Hulme *et al*, 2005). The IPCC's regional scenarios for Africa for the next century indicate that East Africa could receive more rain while southern Africa will probably become drier, and desertification will remain a major threat in arid and semiarid regions (UNEP, 2003). Studies by Janowick (1998) and Ropelewski and Halpert (1987) confirmed that El Nino Southern Oscillation (ENSO)¹ is one of the most important controlling factors with regard to inter-annual rainfall variability in some regions of Africa. These studies found that two regions having the most dominant ENSO influences are eastern equatorial Africa during the short October to November rainy season and south-eastern Africa during the main November to February wet season. Southern Africa's sensitivity to ENSO is strongest over South Africa during December to February before migrating northwards over Zimbabwe and Mozambique during March to May season (Hulme *et al*, 2005).

The factsheet on Climate variability and change in Zimbabwe highlighted a number of issues on the country's climate. Zimbabwe is experiencing more hot and fewer cold days than before; with the country's annual mean surface temperature having warmed by 0.4°C from 1900 to 2000 (CwDCC (b), n.d.). The period 1980 to 2000 has been the warmest and the driest; and the timing and amount of rainfall received are becoming increasingly uncertain. The last thirty years (from 1980) have seen a trend towards reduced rainfall or heavy rainfall and drought occurring in the same season. Mutekwa (2009) also concurred noting that Zimbabwe has of late been experiencing frequent droughts alternating with periods of very high rainfall, in some cases, floods and mid-season prolonged dry spells are being experienced in the same season. Uganai (1997 cited by Balling, 2005) examined temperature trends for Zimbabwe from 1933 to 1993, in which data from the rural areas showed a rise in maximum temperatures, a decrease in minimum temperatures and a substantial rise in the diurnal temperature range.

2.1.1 Initiatives that were undertaken to enhance climate change awareness in Zimbabwe

Zimbabwe has various government ministries; the one responsible for environmental and climate issues has been the Ministry of Mines, Environment and Tourism, which is now called Ministry of Environment and Natural Resources Management. The Ministry of Mines, Environment and Tourism (1998) noted that in 1987 the Government of Zimbabwe produced a policy document which was a blue- print for the conservation of the environment called "National Conservation Strategy". This document paved way for most environmental

¹ **El Niño-southern oscillation (ENSO):** is a complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts, such as altered marine habitats, rainfall changes, floods, droughts, and changes in storm patterns (UN/ISDR, 2010).

programmes in Zimbabwe, including the signing and ratification of the United Nations Framework Convention on Climate Change (UNFCCC) by Zimbabwe in Rio de Janeiro. Climate change activities which followed the issuing of this document were part of environmental programmes based on this historic policy document. In an attempt to meet the obligation of Article 6 of the UNFCCC which requires Parties to the Convention to promote and facilitate the development and implementation of educational and public awareness programmes on climate change and its impact, Zimbabwe conducted climate change awareness workshops targeted at the grassroots community, industry, schools and universities, professional groups and policy makers. These climate change workshops were cofunded by both the Government of Zimbabwe and donors (ibid).

The Zimbabwean government had its initial national communication to the UNFCCC in 1998. In the communication it proposed climate change projects which fell in two categories namely: *enabling activities and mitigation options* (Ministry of Mines, Environment and Tourism, 1998). Of relevance to increasing climate change awareness were two projects that fell under the enabling activities, and these proposed projects included:

- Enhancing capacity in present research institutions to provide information on climate change
- Reviewing, updating and systematic dissemination of climate change data. This was to enhance internal climate change communications within the country, which was highlighted to be a must for successful implementation of any mitigation and adaptation options.

The Zimbabwean government also took other various initiatives to increase climate change awareness in the country, these initiatives include workshops such as the *Climate Change Roundtable* organised in 2009 by the Ministry of Environment and Natural Resources Management in conjunction with COMESA with financial support from the Norwegian Embassy (Ministry of Environment and Natural Resources Management, 2009). It was highlighted that the aim of the workshop amongst other objectives was to create awareness and initiate dialogue on climate change in the country with full participation of legislators, industry and insurance sectors, bankers, and other players.

During the Climate change roundtable there were discussions on climate change awareness and advocacy. It was recognised that the issues of awareness and advocacy at different levels of society were very pertinent and required urgent attention if the country was to effectively address the issues of climate change adaptation and mitigation. It was noted that across all the levels of society, awareness was low and needed to be enhanced. It was recognised that the issues of climate change awareness could be stratified and tackled at three level: Level 1 (Policy Makers); Level 2 (community based organisations, business, civil society, researchers, media); and Level 3 (Communities) (Ministry of Environment and Natural Resources Management, 2009).

2.2 Barriers to smallholder farmers' adaptation to climate change

Given the threats to livelihoods due to current climate variability and expected change there is need for rural households to adapt. Gbetibouo (2008) noted that the extent to which the adverse impacts of climate change are felt depends in large part on the extent of adaptation in response to climate change, without adaptation, climate change would be detrimental to the agricultural sector, but with adaptation, vulnerability can be significantly reduced. Adaptation is a process through which societies make themselves better able to cope with an uncertain

future, adapting to climate change involves taking the right measures to reduce the negative effects of climate change (or exploit the positive ones) by making the appropriate adjustments and changes (UNFCCC, 2007).

The Coping with Drought & Climate Change (CwDCC) project in Zimbabwe identified some barriers to replication of successful adaptive strategies, these are: information; institutions; inclusion; and finance (CwDCC (a)). *Information barriers* are due to limited awareness among policy makers and development practitioners about the risks posed by climate change and how these relate to local development priorities. *Institutional barriers* contribute to weak coordination between those working on climate change, development and disaster risk reduction. *Inclusion barriers* occur because there are limited platforms to share and capture experiences from different stakeholders while *financial barriers* are there because the cost of adaptation is substantial (ibid).

2.3 The Link between information, knowledge and adaptation

Any comprehensive strategy for addressing climate change must include both adaptation and mitigation. Adaptation can be autonomous or planned. *Autonomous* adaptation is the ongoing implementation of existing knowledge and technology in response to the changes in climate experienced; while *planned* adaptation is the increase in adaptive capacity by mobilizing institutions and policies to establish or strengthen conditions that are favourable to effective adaptation and investment in new technologies and infrastructure (IFAD, 2008). For meaningful adaptation and mitigation, individuals, households, and communities should be aware and have the necessary knowledge on what should and should not be done in addressing the problem.

If rural households have access to information, it will enhance their awareness and adaptation capacity, as Brodnig and Mayer-Schonberger (2000 cited by Thioune, 2003) noted that accurate and reliable information is a key element for sustainable development. Information can lead to knowledge and that knowledge is a prerequisite for development (Mansell and Wehn 1998; Danofsky 2005; Hamel 2005; Ahmed 2005 as quoted by Ahmed 2007). Farmers' ability to perceive climate change is a key precondition for their choice to adapt (Gbetibouo, 2008).

The African Climate Change Resilience Alliance (ACCRA) consortium identified five characteristics of adaptive capacity, and one of the characteristics is *knowledge and Information*. It highlights that successful adaptation requires information and understanding of future change, knowledge around adaptation options, whereby it is important to ensure that systems are in place to distribute relevant information at both national and regional scales e.g. early warning systems; meteorological data and forecasting; and climate impact data (ACCRA, 2010). Mutekwa (2009) studied climate change impacts and adaptation in the smallholder sector in Mazvihwa area of Zvishavane District in Zimbabwe, and the findings were as follows. The majority of the farmers (53%) professed ignorance about climate change and its potential consequences, whilst 47% indicated that there was some kind of change that they had observed in recent years.

As has been noted by various scholars, there is need to disseminate climate information and ensure communication between scientists/researchers; extension and users of information especially the farmers. Lambrou & Nelson (2010) noted that in dealing with climate variability it is essential to have a system of information that is accessible to a wider social spectrum and is democratically applied without biases due to gender, property ownership, caste, age or religion. It is of crucial importance that information is received by women as

well as men, in the form and content that is appropriate, and tailored to the decision-making needs of farmers and must arrive on time (ibid).

2.4 Applications of Information and Communication Technologies (ICTs)

The term Information and Communication Technologies (ICTs) is used to refer to hardware, software, networks and media for collection, storage, processing, transmission and presentation of information in the formats of voice, data, text and images (World Bank (n.d.) ; Nyirenda-Jere, 2010). ICTs are diverse, they ranging from telephones, radios and TVs to more complex technologies such as internet technologies, mobile telephony, computers and databases (ibid). The primary purpose of ICTs is to provide an enabling environment for the generation of ideas, their dissemination and use. Through ICTs, the diffusion and sharing of knowledge is enabled through open access to information and better coordination of knowledge. ICTs have been and continue to be used to an ever increasing extent in education and learning through computer aided learning and distance learning (ITU, 2008).

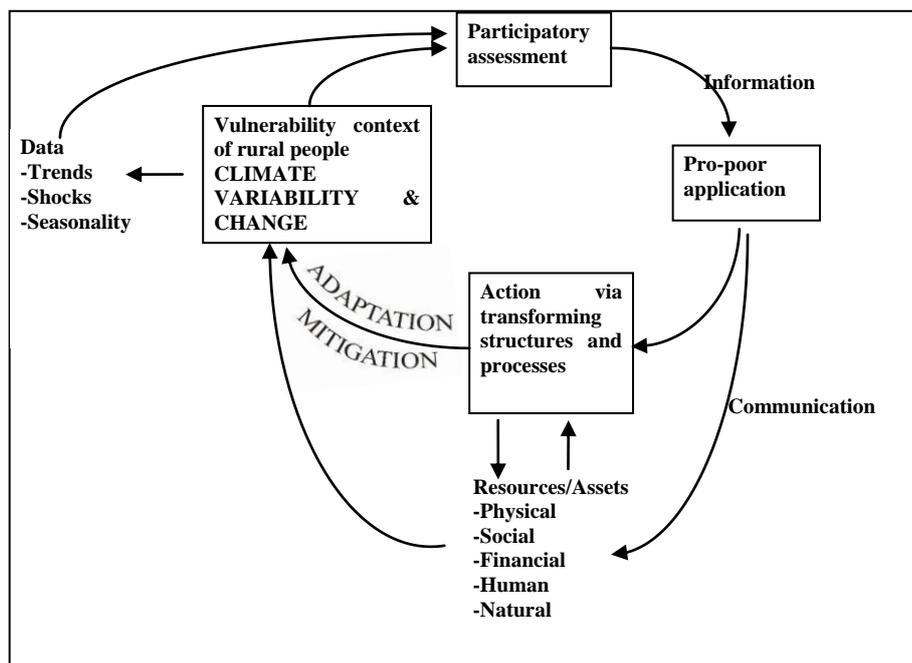
Likening the ICT revolution to the first machine-driven industrial revolution , Baskaran & Muchie (2006) noted that ICTs have generated fundamental changes in the socio-economic life of people and nations across the world. The UN Millennium Project (2005) noted that ICT will become one of the main enablers in pursuit of poverty alleviation, as a facilitator of networking, processing, distribution and sharing of knowledge and information. There are many ICT applications in environmental issues which are categorised as: environmental observation; environmental analysis; environmental planning; environmental management and protection; impact and mitigating effects of ICTs utilization; and environmental capacity building (ITU, 2008). The role of ICTs in capacity building is of importance to climate change adaptation. Capacity building includes efforts to increase public awareness of environmental issues and priorities, the development of professionals involved either directly or indirectly in the environment, as well as integrating environmental content into formal education (ibid). Munyua (2007) noted that some of the emerging ICT applications in small-scale agriculture in Africa include: geographic information system (GIS), decision support systems (DSS), market information system (MIS), distance learning, databases, land use planning, public access facilities, mobile applications, restructuring of extension and personal digital assistants (PDAs).

2.5 Conceptual Framework

The relationship between climate variability and change and ICTs is conceptualised using a sustainable livelihoods (SL) framework. Other researchers who have used the SL framework include Duncombe (2006) who analysed the ICT applications for poverty reduction via micro-enterprise in Botswana. Sife, Kiondo, & Lyimo-Macha (2010) also employed the SL framework in their study on the contribution of mobile phones to rural livelihoods in Morogoro region of Tanzania.

Duncombe (2006) integrated the information chain proposed by Heeks (1999; 2005) to show the information and communication processes in the livelihoods framework. In this paper, climate variability and change aspects were added to the Duncombe and Heeks framework as shown in Figure 1. Duncombe (2006) noted that information has an analytical and a functional role within the framework. Of importance is, if climate variability and change data on trends, shocks, and seasonality is available and through participatory assessment is converted to information and communicated to the people, they are better able to adapt to and also participate in the mitigation of climate change.

Figure 1: Climate change information and communication processes in the livelihoods framework



(Source: Adapted from Duncombe (2006) who adapted it the information chain by Heeks (1999))

From the conceptual framework, ICTs play an important role by facilitating communication between people within rural areas and also with people outside. ICTs also play an important role by transmitting climate change information from the research field to the rural people and from rural people to researchers; however this information is important only if the rural people understand the information, which leads to knowledge. Therefore ICTs will contribute to sustainable development in rural areas when they facilitate communication amongst the people within and outside the rural area; when they reduce transaction costs and facilitate information generation, exchange and knowledge creation.

3 RESEARCH METHODS

3.1 The Study Area

Zimbabwe has 10 provinces, and from the 10 provinces only one province (Mashonaland East) was selected. According to the 2002 Census, Zimbabwe has a total population of about 11 634 663 people, and Mashonaland East province has a total population of about 1 127 413 people. Most of the population in the province is rural while the urban population accounts for about 24 percent. The total number of households in the province is 309 198. It has 11 districts namely: Chikomba; Goromonzi; Hwedza; Marondera; Mudzi; Murewa; Mutoko; Seke; UMP; Marondera (urban); and Ruwa (CSO, 2004). From the 11 districts, 2 districts were selected purposively; they are Seke and Murewa districts. Seke district was selected because it is a close to the capital city Harare and Chitungwiza town, while Murewa district is a bit far away from the major urban areas. The choice of the two districts is important in evaluating the effect of proximity to urban areas in terms of access to ICTs and climate change awareness.

Seke district has population of 76 369 people and 18 854 households while Murewa district has a population of 160 321 people and a total of 37 152 households. The sample size used in the study is 300 whereby 150 respondents were selected from each of the two districts. A

multi-stage sampling approach was used. The data collection was conducted from May to August 2011.

3.2 Data Analysis

The study focused on two main issues namely: access to and use of Information and Communication Technologies (ICTs) and climate change awareness. In looking at ICTs both old and new ICTs were analysed, namely: radio; television; video cassette recorder (VCR); digital video disc (DVD) player; fixed telephone; mobile phone; satellite decoder; computer; internet; and the traditional print media (newspapers; farming/environmental magazines; business magazines; entertainment magazines; church magazines; and posters). Various questions were formulated to explore different aspects of access to and use of these ICTs. Various analytical tools were used, which included descriptive statistics; correlation analysis; and regression analysis. Data handling and analytical packages used in the study were SPSS and STATA.

4 RESULTS AND DISCUSSIONS OF THE RESEARCH

4.1 Household demography

A total of 150 respondents were interviewed in each of the two districts to give a total of 300 respondents. The information was entered and one questionnaire was not included in the dataset due to a number of inconsistencies to give a total of 299. From 299 sampled households, 96 (32.1%) were female-headed while 203 (67.9%) were male-headed households as shown in Table 1.

Table 1: Gender of Household heads in the sample by district

		Gender of Household head			
		Female	Male	Total	
District	Murewa	Count	47	103	150
		<i>% within District</i>	31.3%	68.7%	100.0%
	Seke	Count	49	100	149
		<i>% within District</i>	32.9%	67.1%	100.0%
Total		Count	96	203	299
		<i>% within District</i>	32.1%	67.9%	100.0%

Source: Survey data

The minimum and maximum ages of household heads in the sampled households were 23 and 98 years respectively with a mean age of 52.23 years. The minimum and maximum household sizes were 1 and 18 respectively with a mean of 5.84. The majority of the household heads had some basic education while only 4.3% of the household heads did not have any form of formal education.

4.2 Climate change awareness

The majority of the respondents indicated that they were aware of climate change, with about 86.3% indicating that were aware while 13.7% were not. A greater proportion of respondents who were aware of climate change were from Murewa district (94%) while Seke had 78.5% as shown in Table 2.

Table 2: Climate change awareness by district

		Aware of climate change
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		No	Yes	Total	
District	Murewa	Count	9	141	150
		% within District	6.0%	94.0%	100.0%
	Seke	Count	32	117	149
		% within District	21.5%	78.5%	100.0%
Total		Count	41	258	299
		% within District	13.7%	86.3%	100.0%

4.3 Knowledge and ownership of Information and Communication technologies

The study focused on both old and new ICTs namely: radio; television; video cassette recorder (VCR); digital video disc (DVD) player; fixed telephone; mobile phone; satellite decoder; computer; internet; and the traditional print media (newspapers; farming/environmental magazines; business magazines; entertainment magazines; church magazines; and posters). The results on ICT knowledge and ownership are shown in Table 3 below. The most known ICT in the two district was the radio, 98% of the respondents knew it, it was followed by the mobile phone (95%) and the least known was the internet (48.5%). In terms of ownership, the greatest percentage of households owned a mobile phone (77.7%), followed by the radio (74.8%). The least owned ICTs were: the computer (3.3%); internet (2.0%); and fixed telephone (2.0%).

Table 3: Knowledge and ownership of ICTs disaggregated by district

ICT		Know			Own		
		Murewa	Seke	Total	Murewa	Seke	Total
		%	%	%	%	%	%
Radio	No	1.3	2.7	2.0	22.1	28.2	25.2
	Yes	98.7	97.3	98.0	77.9	71.8	74.8
Television	No	13.3	7.4	10.4	59.3	48.3	53.8
	Yes	86.7	92.6	89.6	40.7	51.7	46.2
Satellite decoder	No	34.7	39.6	37.1	92.0	86.6	89.3
	Yes	65.3	60.4	62.9	8.0	13.4	10.7
Video Cassette Recorder	No	36.7	38.9	37.8	92.0	85.2	88.6
	Yes	63.3	61.1	62.2	8.0	14.8	11.4
Digital Video Disc player	No	34.7	39.9	37.3	84.7	85.9	85.3
	Yes	65.3	60.1	62.7	15.3	14.1	14.7
Fixed Telephone	No	24.0	34.2	29.1	98.0	98.0	98.0
	Yes	76.0	65.8	70.9	2.0	2.0	2.0
Mobile phone	No	5.3	4.7	5.0	29.3	14.8	22.1
	Yes	94.7	95.3	95.0	70.7	85.2	77.9
Computer	No	34.7	39.6	37.1	98.0	95.3	96.7
	Yes	65.3	60.4	62.9	2.0	4.7	3.3
Internet connection	No	48.0	55.0	51.5	98.7	97.3	98.0
	Yes	52.0	45.0	48.5	1.3	2.7	2.0

Source: Survey data

In terms of print media the greatest number of respondents indicated that they read the newspaper (72.4%) and the least read were business magazines (40.5%) as shown in Table 4.

Table 4: Readership of various forms of print media

		District		
		Murewa	Seke	Total
		%	%	%
Newspapers	No	32.7	22.1	27.4
	Yes	67.3	77.9	72.6
Farming/environmental magazines	No	54.7	42.3	48.5
	Yes	45.3	57.7	51.5
Business magazines	No	69.3	49.7	59.5
	Yes	30.7	50.3	40.5
Entertainment magazines	No	66.0	51.0	58.5
	Yes	34.0	49.0	41.5
Read_ church magazines	No	52.0	37.6	44.8
	Yes	48.0	62.4	55.2
Posters	No	59.5	40.3	49.8
	Yes	40.5	59.7	50.2

Source: Survey data

4.4 Exploring the relationship between ICTs and climate change awareness

To explore the relationship between ICTs and climate change awareness (whether the respondent indicated that he/she is aware of climate), correlation analysis were conducted on ownership of the various forms of ICTs and climate change awareness in SPSS. The results are shown in Table 5 below. Three ICTs namely: radio; video cassette recorder; and mobile phone, were found to be significantly (at 5%) correlating (positively) with whether the respondent indicated that he/she was aware of climate change. From the print media only the frequency of reading Farming/ Environmental magazines significantly correlated (positively) with climate change awareness.

Table 5: Correlation results between climate change awareness and various ICTs

Variable	Spearman's rho Correlation Coefficient	Two-tailed significance level
Radio ownership	0.2065	0.0004***
Television ownership	0.0410	0.4819
Satellite decoder ownership	0.0451	0.4383
Video Cassette Recorder ownership	0.1178	0.0419**
Digital Video Disc player ownership	0.0815	0.1596
Telephone ownership	0.0573	0.3246
Mobile phone ownership	0.1810	0.0018***
Computer ownership	-0.0534	0.3584
Internet connection	0.0468	0.4220
Frequency of reading newspapers	0.0294	0.6139
Frequency of reading farming/environmental magazines	0.1408	0.0150**
Frequency of reading business magazines	0.0771	0.1836
Frequency of reading entertainment	0.0731	0.2073

magazines		
Frequency of reading church magazines	0.0749	0.1966
Frequency of reading posters	0.0040	0.9459

4.5 REGRESSION RESULTS

To further explore the relationship between ICTs and climate change awareness a logistic regression model was used. The dependent variable was a binary variable ($1=yes, 0=no$) to the question (*Are you aware of climate change?*) and the independent variables were ownership (number) of the various ICTs (radio; television; satellite decoder; video cassette recorder; digital video disc player; mobile phone; computer; internet); and print media namely: reading newspaper; reading farming/ environmental magazines; reading business magazines; reading entertainment magazines; reading church magazines; and reading posters. The regression results as presented in Table 6 below. Fixed telephone and internet connection variables were dropped by the logistic model in STATA as they predicted success perfectly. Four variables were found to significantly influence the dependent variable (whether a respondent indicated that he/she was aware of climate change) and these are: radio; television; and mobile phone ownership and from print media only reading of the Farming/Environmental magazines had significant influence.

Table 6: Logistic regression results

Variable	Odds Ratio	Significance level
Radio ownership	3.4226	0.003***
Television ownership	0.2915	0.009***
Satellite decoder ownership	0.7651	0.776
Video Cassette Recorder ownership	11.4425	0.185
Digital Video Disc player ownership	1.8946	0.480
Mobile phone ownership	1.8269	0.011**
Computer ownership	0.1440	0.140
Frequency of reading Newspapers	0.8841	0.456
Frequency of reading Farming/ Environmental magazines	1.6723	0.022**
Frequency of reading Business magazines	0.8754	0.657
Frequency of reading Entertainment magazines	1.0247	0.930
Frequency of reading Church magazines	1.0242	0.867
Frequency of reading Posters	0.7907	0.108

Source: Survey data

Significance level: * is 10%; ** is 5%; *** is 1%

The logistic results presented in Table 6 above show two columns, one for the odds ratio² and the other for the significance level. The most significant variables were: radio and television ownership, which are significant at 1% significance level. Mobile phone ownership and frequency of reading Farming/Environmental magazines were significant at 5% level. The odd ratios of radio ownership; mobile phone ownership; and frequency of reading Farming/Environmental magazines are greater than 1, which means ownership or an increase in the ownership of the radio and mobile phone; and an increase in the frequency of reading

² Odds ratio is an indicator of the change in odds resulting from a unit change in the predictor. Odds ratio can be interpreted as: if the value is greater than 1, it means as the predictor increases, the odds of an outcome occurring also increase; a value less 1 indicates that as the predictor increases, the odds of an outcome occurring decreases (Field, 2009: 270-271).

Farm/Environmental magazines increases the odds of an individual being aware of climate change. The odds ratio of television ownership is less than 1, which means ownership or an increase in ownership of the television reduces the odds of an individual being aware of climate change.

This result on television ownership is contra to *a priori* expectation. However, the correlation analysis results presented in Table 5 and Table 7 below, between climate change awareness and television ownership show that there is no significant relationship between the two, hence the negative relationship shown by regression results could be due to other factors or the content that is being broadcast through the television does not carry any climate change awareness information or the climate change awareness information is available but the people who own the televisions do not view that content. This necessitates to the need to further explore the relationship of television ownership with other variables. Correlation analyses were conducted on four variables namely: television ownership; aware of climate change; whether the household got some agricultural income; and whether the household got non-agricultural income. The results of the correlation analysis are presented in Table 7 below. Significant association was found between Aware of climate change and Agricultural income, however no significant association was found between Aware of climate change and Non-agricultural income. Significant association was also found between having Non-agricultural income sources and Television ownership.

Table 7: Spearman's rho correlation coefficients

		Aware of climate change	Agricultural income	Non-agricultural Income
Agricultural income	Correlation Coefficient	0.199		
	<i>Sig. (2-tailed)</i>	<i>0.001**</i>		
Non-agricultural Income	Correlation Coefficient	0.081	-0.044	
	<i>Sig. (2-tailed)</i>	<i>0.161</i>	<i>0.452</i>	
Television ownership	Correlation Coefficient	0.041	0.013	0.212
	<i>Sig. (2-tailed)</i>	<i>0.482</i>	<i>0.818</i>	<i>0.000**</i>

Source: Survey data

** Correlation is significant at the 0.01 level (2-tailed).

About 65.6% of household head who had non-agricultural income sources owned a television while 41.2% of household heads who did not have non-agricultural income owned a television. This could give possible reasons for the negative relationship between television ownership and climate change awareness. The positive correlation between agricultural income and aware of climate change suggests that people who are mainly dependent on agriculture are likely to be aware of climate change compared to those with non-agricultural income. For those with non-agricultural income sources, they could be less concerned with climate change issues, so even if they own the television they might be less interested in programs that relate to climate change and agricultural issues.

5 Conclusion

The study found out that the majority of respondents are aware of climate change. Though there are many sources of information, ICTs were found to significantly influence climate change awareness. ICTs such as the radio and mobile phone are likely to increase the odds of being aware of climate change. Reading Farming/Environmental magazines also had a significant influence on odds of being aware of climate change. However a negative relationship was found between television ownership and the odds of climate change awareness.

6 Areas for further research

This paper looked at the relationship between ICTs and climate change awareness from the rural people's perspective whereby the aim of the study was to find out whether ICTs are contributing to rural people's awareness to climate change. It did not look at the content that is transmitted or broadcast through these ICTs. The question that will need further research are: Is climate change awareness and other climate change information made available through the ICTs? If this information is available is it in the right format in which all segments of the population can access it? A shortcoming of this study is that the target population were household heads; it did not look at climate change awareness from other segments of the population e.g. the youth, which also necessitates the need for further research. The findings indicate a high level of climate change awareness in the two districts under study, however there is need to evaluate climate change awareness in other remote districts of the country and also in urban areas. This paper looked only at whether an individual considered him/herself to be aware of climate change. Climate change awareness includes many issues: it includes knowing what is climate change; its causes and effects; ways of adapting and mitigating; and other variables. These issues need to be evaluated by further research.

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