Research on Humanities and Social Sciences
ISSN 2224-5766 (Paper) ISSN 2225-0484 (Online)
Vol.8, No.22, 2018

Understanding Information Communication Strategies Among Farmers for Effective Utilization of Climate Research and Forecast in the Niger-Delta, Nigeria

Onwuemele Andrew
Nigerian Institute of Social and Economic Research (NISER), Oyo Road, Ojo Ibadan, Oyo State Nigeria

Abstract
Agriculture constitutes the principal livelihood of 70 per cent of the world's poor and the primary means of their food security. The poor, who depend on agriculture for sustenance and livelihoods is currently faced with the challenges of changing climatic conditions. Generally, it is believed that the impact is most felt by the poor due to their weak capacity to adapt. The Niger-Delta region where the study is based is particularly vulnerable to climate change due to its location in the coastal region coupled with its high mean annual rainfall of about 4500mm. Reports on the environmental state of the region are conclusive that the area has become an ecological wasteland. Access to accurate and up to date climate research and forecast are vital for climate change adaptation practices. Other studies have shown that the use of ICT including internet, mobile phones, emails, community radio, TV, telecenters, computers are not fully utilized by farmers, especially in rural areas in the region. It is therefore necessary to identify the information communication and knowledge sharing strategies among farmers in the region with a view to mainstreaming them into climate research and seasonal climate forecast dissemination strategies in the Niger-delta region of Nigeria. This study aims at understanding farmer's information communication strategies in the Niger-delta region of Nigeria. Two local communities (Illushi and Isoko) in the region that are noted for high agricultural activities but highly vulnerable to climate change were purposively selected for the study. Data for the study were obtained through questionnaire administration and in-depth interviews (IDI). Focus group discussions (FGD) were also conducted for selected farming groups in each of the communities. Analysis of data was done with the use of statistical packages of the Social Sciences (SPSS) using mainly descriptive statistics while the IDI and FGD were content analysed. The study identified the main information communication strategies among farmers to include village meetings, town hall meetings, town crier, traditional shrines and deity, churches, market places, local bars (pepper soup joint), age group meetings, among others. Among other recommendations, the paper calls for the integration of these local medium of information sharing among farmers with the modern media and the translation of climate forecast and research outputs into local languages to enhance access and utilization of climate research and forecasts among farmers in the Niger-Delta region.
Keywords: Information; Communication; Strategies; Climate Forecast; Niger-Delta, Nigeria

1. Introduction

Humans require food to live, and the agricultural sector plays significant roles in providing the food requirements of many nations of the world. However, the sector is highly sensitive to fluctuations in weather and climate. Climate variability and climate extremes have severe impacts on agricultural sector in several respects. For instance, prolonged droughts affect agricultural output thus leading to malnutrition and starvation for both the human population and for livestock while floods affect food stocks, remove the fertile topsoil and impair food production for seasons afterwards with similar impacts, and contribute significantly to the severity and extent of reduced food production leading to severe shortages. Thus, extreme climatic conditions can disrupt national food production hence affecting national food security (Nyenzi and Malone, 2005; Muhammad Ateeq-Ur-Rehman et al., 2018).

Climate research and forecasts have been shown to be useful in planning various activities that depend on climate information and products including agriculture. Weather and climate forecasts given in good time provide an opportunity to plan mitigation measures before the season begins (McMichael et al 2003, Patz, 2002). In the agriculture sector, farmers are able to select more effective planting times, and choose the most appropriate crops for the coming season. For the health sector, early warning systems help to improve surveillance on diseases affected by climate conditions (such as Malaria, Dengue Fever, etc.) and help mitigate against the suffering resulting from weather extremes such as heat waves and winter cold, and urban smog events (Nyenzi and Malone, 2005; Ayubu et al., 2012).

According to Tall et al, (2012), seasonal forecasts have been underutilized for many reasons. Firstly, there had been no sustained dialogue between climate services providers and end users. Secondly, a shift was needed from a mindset of disaster response to one of preparedness and early action. Furthermore, convincing donors to fund preparedness activities for predicted events that were only probably not certain was a challenge. Technically, information provided by climate services providers was largely incomprehensible to decision

maker/disaster manager. Scientifically, the information was often not salient to the latter's information needs and was given in terms of probabilities to reflect uncertainty inherent in the forecast, requiring new strategies for taking decisive action. This disconnect between service providers and users is a global issue and this partly explains why vulnerable populations worldwide continue to be impacted by predictable natural hazards, as illustrated, for instance, by the 2005 famine in Niger, cyclone Nargis in Myanmar, and hurricane Katrina in the United States (Suarez, 2009). Despite the significant potential of early information about likely climatic hazards to aid vulnerable groups in better coping with climate variability, save lives, and preserve livelihoods, there are only a few haphazard instances of successful transmission and use of available climate and weather forecasts, and other climate risk management tools by policy makers and communities at risk (Sejabaledi, 2016).

One of the spheres mostly hit by this scenario in Nigeria is the smallholder farmer who constitutes over 70% of the countries farming population. Globally, smallholder farmers in the developing world are particularly vulnerable to the impacts of climate change. Recently, international tensions and concerns are heightening over what the impact of climate will have on the environment and agricultural produce (NEST, 2004; BNRCC, 2008; Apata, et al 2009). Also, how agricultural and food-distribution systems will be further stressed up by the shifting of temperatures and precipitating belts, especially if changes are rapid and not planned for (NEST, 2004). To a large extent, while smallholder's farmers have continuously been adapting to varying weather and climatic conditions; however, increasingly erratic climate variability and the rapid pace of other drivers of change are overwhelming their capacity to adapt (May et al, 2013). Consequently, the need for improved access to climate information services have become more critical more than ever before among vulnerable communities and smallholder farmers in the developing world.

The Niger-Delta region where the study is based is particularly vulnerable to climate change due to its location in the coastal region coupled with its high mean annual rainfall of about 4500mm and hence potentially vulnerable to sea level rise and flooding. The region is also faced with myriads of environmental problems resulting from oil exploration and exploitation activities. Reports on the environmental state of the region are conclusive that the area has become an ecological wasteland (See Figure 1 for Map of the Niger-Delta). Studies have shown that very few farmers in the Niger-Delta use the results of climate research and only few have access to seasonal forecasts, even though the vast majority seem willing to use such information. Other studies have shown that ICT including internet, mobile phones, emails, community radio, TV, telecenters, computers are not fully utilized by farmers, especially in rural areas. This has been as a result of high cost of ICT services, low literacy level, low income and limited number of service providers in rural areas (Lwoga et al; 2010).

It is germane to state that before the advent of Information Communication Technology (ICT), farmers in various communities in the region have been interacting and effectively sharing information among themselves. It is therefore necessary to identify the information communication and knowledge sharing strategies among farmers in the region with a view to mainstreaming them into climate research and seasonal climate forecast dissemination strategies in the Niger-delta region of Nigeria. This study aims at understanding farmer's information communication strategies in the Niger-delta region of Nigeria with a view to mainstreaming same into channels of dissemination of climate researches and forecast in the Niger-Delta region.

2.0 The Niger Delta: Physical and Socio-Economic Setting

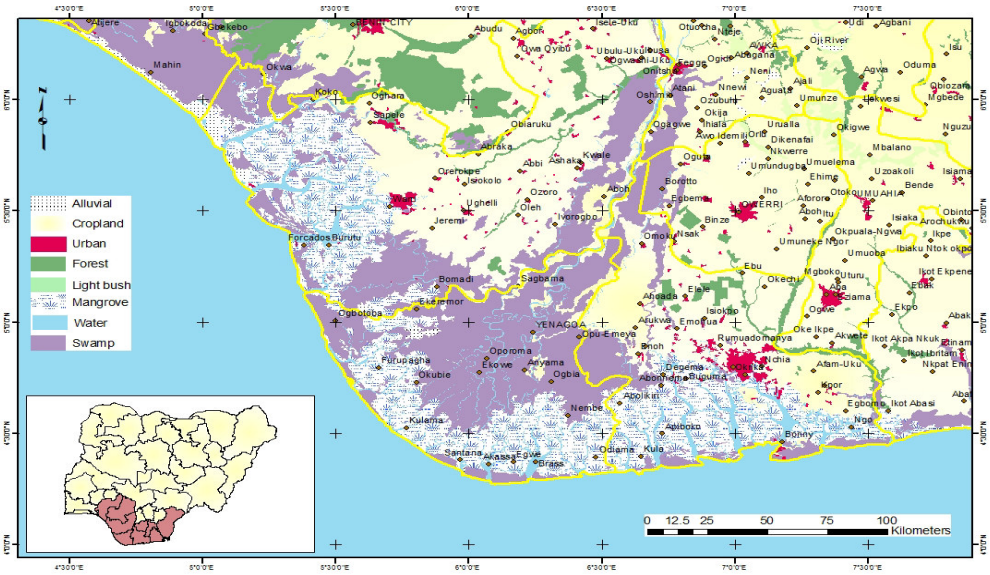
The Niger Delta covers all the land between latitude $4^{o}15^{1}$N and $4^{o}50^{1}$N and longitude $5^{o}25^{1}$E and $7^{o}37^{1}$E (Powell et al., 1985). It is characterized by extensive interconnectivity of creeks, deltaic tributaries, flood plains, mangrove swamps and other The Niger Delta is one of the world's 10 most important wetland and coastal marine ecosystems and is home to some 31 million people (Uyigue and Agho, 2007; Ogba and Utang, 2007). As opined by Iyayi (2004), it is the richest wetland in the world. It is also the location of massive oil deposits, which have been extracted for decades by the government of Nigeria and by multinational oil companies. The area covers approximately 25,900 square kilometres (ERML, 1997) while the broader Niger Delta region, which includes all oil producing areas and others considered relevant for reasons of administrative convenience, political expedience and development objectives, extends the land area to 75,000 square kilometres (UNDP, 2006). This area covers nine states in Nigeria including Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers States. It has been described as the largest wetland in Africa and among the three largest in the world (CLO, 2002). The Delta's environment can be broken down into four ecological zones: coastal barrier islands, mangrove swamp forests, freshwater swamps, and lowland rainforests (Awosika, 1995). This incredibly well-endowed ecosystem contains one of the highest concentrations of biodiversity on the planet, in addition to supporting abundant flora and fauna, arable terrain that can sustain a wide variety of crops, lumber or agricultural trees, and more species of freshwater fish than any ecosystem in West Africa.

The region has emerged as one of the most ecologically sensitive regions in Nigeria. Resources (oil and gas) from the region are the main source of revenue for the Nigerian state, accounting for about 97% of the country's total export. Oil was first discovered in the region in Oloibiri in 1953 and since then oil has come to stay as Nigeria's singular most important foreign exchange earner. Figure 1 is the morphological map of Niger Delta.

The Niger Delta is highly susceptible to adverse environmental changes occasioned by climate change because it is located in the coast. Coastal regions of the world are already experiencing flooding due to rise in sea level. Amid the impact of climatic change, the region is also faced with myriads of environmental problems resulting from oil exploration and exploitation activities. Reports on the environmental state of the Niger Delta are conclusive that the area has become an ecological wasteland (Amnesty International, 2009; Okpuri and Ibaba, 2008; Uyigue and Agho, 2007; Saliu et al, 2007; Ogba and Utang, 2007; Aleksandrova, Gain and Giupponi, 2015).

Onofeghara (1990) estimated that the Niger Delta could lose over 15000 square kilometers of land by the year 2100 with a one meter rise in sea level while a 20cm rise in sea level will inundate 3400 km2 of the Nigerian coastland (Onofeghara, 1990). It is estimated that with a sea level rise of 30cm, about 1 to 2 million people will be affected. In all this, it is predicted that Nigeria will lose about $9 billion as a result of the sea level rise while at least 80% of the people of the Niger Delta will be displaced due to the low level of the region (Onofeghara, 1990).

Figure 1: Map of the Niger-Delta



The United Nations Development Program (UNDP) describes the region as suffering from "administrative neglect, crumbling social infrastructure and services, high unemployment, social deprivation, abject poverty, filth and squalor, and endemic conflict" (UNDP, 1995). These indicators make the people to be highly vulnerable to climate change. This poor development indicators in contrast to its wealth generated by oil, has become one of the world's starkest and most disturbing examples of the "resource curse". Oil has generated an estimated US$600 billion since the 1960s (UNDP, 1995). Despite this, many people in the oil-producing areas have to drink, cook with and wash in polluted water, and eat fish contaminated with oil and other toxins. More than 60 per cent of people in the region depend on the natural environment for their livelihood (Uyigue and Agho, 2007). The Region accounts for over 90 per cent of Nigeria's proven gas and oil reserves.

2.1 Analytical Framework

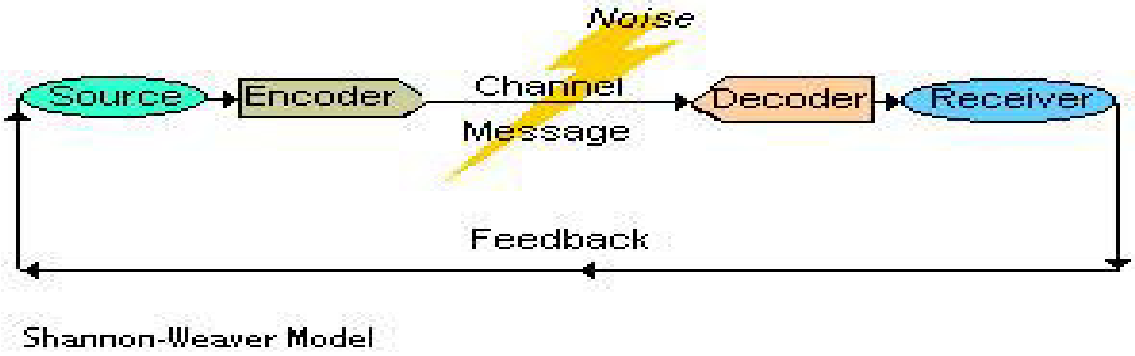
Communication is as old as human history; many indicators prove that effective communication is the main factor enhancing civilization through history. This is why communication is considered a multi-culture phenomenon. Communication is an important tool for influencing human behaviour. Climate change adaptation and mitigation strategies are anchored on changes in human behaviour in relation to their environment. This explains why effective communication has taken the front burner in climate risk management globally. Communication can be defined as a process of transmitting ideas, information and attitudes by the use of symbols, words, pictures, figures from the source to a receiver, for the purpose of influencing with intent". So communication is considered as a process through which senders and receivers of messages interact in a given social context.

Several models have been developed to explain the process of communication. One of the most prominent of these models is the Shannon and Weaver (1949) model of a communication. The model consists of a sender, a message, a channel where the message travels, noise or interference and a receiver (Figure 2). Shannon-Weaver model identifies eight prerequisite elements that are fundamental for communication, or information

transmission, to occur. These elements are:

1. **Source:** The source of communication is the initiator, or originator of the idea, data or information to be transmitted. It is an individual or group that has a specific reason to begin the communication process.
2. **Encoder:** This refers to the specified format for the message to take including text, audio, digital or images, and that conveys meaning.
3. **Message:** The information, idea, data or concept that is being communicated from one end of the model to the other is the message.
4. **Channel:** This is the medium or pathways through which the information, idea, data or concept is transmitted. It is essential for meaningful communication that a suitable means to transmit the message be selected. The channel is the route that the message travels on, be it verbal, written, electronic, or otherwise.
5. **Noise:** These are interference or distortion that changes the initial message which may be physical, as in an actual sound that muffles the message as it is being said, or it can be semantic, like if the vocabulary used within the message is beyond the knowledge spectrum of its recipient. In order for communication to be effective, noise must be reduced.
6. **Decoder:**Before the message reaches the intended recipient, it must be decoded, or interpreted, from its original form into one that the receiver understands. This is essentially the same interaction as that of source and encoder, only in a reversed sequence.
7. **Receiver**: In order for communication to be executed, there must be a second party at the end of the channel the source has used. The receiver takes in the message that the source has sent out.
8. **Feedback:** For meaningful communication to come to fruition, it is vital that the receiver provides feedback to the source. Feedback relates to the source whether their message has been received, and most importantly, if it has been interpreted accurately. Without feedback, the source would never know if the communication was successful.

Figure 2: Shannon-Weaver Model of Communication



Source: Claude Elwood Shannon, 1948

The eight elements are fundamental for effective communication to occur. While the receivers are humans with diverse socio-economic and cultural characteristics, it is important to consider the receiver in choosing the type of encoder, channel and the message. Above all, the model suggests that feedback from receivers' is crucial as it helps the source to determine the extent to which the message has been received and interpreted accurately. The model provides an appropriate analytical framework for the paper and was be adopted in the subsequent analysis in the paper.

3.0 Materials and Method

The cross-sectional survey design was adopted for the study. The population of the study consists of household heads in Illushi and Isoko communities. The two communities are noted for high agricultural activities but highly vulnerable to climate change. Data for the study were obtained through questionnaire administration and in-depth interviews (IDI). In addition, content analysis was carried out of key official documents of Nigerian meteorology agency NIMET which is the officially recognised national climate agency in Nigeria. Analysis of data was done with the use of statistical packages of the Social Sciences (SPSS) using mainly descriptive statistics while the IDI and FGD were content analysed.

4.0 Results and Discussions

4.1 Characteristics of the Sample Communities

For the community survey, a total of 234 questionnaires were successfully administered using local languages in the study communities. The age, education, livelihood source and income levels of the sampled respondents are summarised in Table 1. Of the total 234 respondents used for the study, 144 representing 61.5% were males.

About 68.7 per cent of the respondents are between the ages of 30 and 50 years. 82.5% of the respondents were married while 7.6 % were single. More than half of the respondents (52.7%) earned less than 10, 000 Naira per month which translate to less than one dollar a day (1 US $ = N150) indicating a high poverty incidence. In addition, about 32.9 per cent of the respondents had no formal education while 49.0 per cent had primary level education reflecting low literacy levels, which can be a barrier to effective access and use climate research and forecasts disseminated through reading materials and in non local language. The major source of livelihood is farming as 48.1 per of the respondents had farming as their major occupation.

Table 1: Gender, Age, Marital Status, Household size and Educational Qualification

Variables	**No. of Respondents**	**% of Respondents**
Sex:		
Male	144	61.5
Female	90	38.5
Total	**234**	**100.0**
Age:	**No. of Respondents**	**% of Respondents**
Below 30 Years	27	11.7
30 -40 Years	84	35.8
40-50 Years	77	32.9
Above 50 Years	46	19.5
Total	**234**	**100.0**
Marital Status:	**No. of Respondents**	**% of Respondents**
Married	164	70.0
Single	42	18.1
Divorced	15	6.2
Separated	14	5.8
Total	**234**	**100.0**
Educational Qualification:	**No. of Respondents**	**% of Respondents**
No formal education	77	32.9
Primary education	115	49.0
Secondary education	37	16.0
Tertiary	5	2.1
Total	**234**	**100.0**
Occupation:	**No. of Respondents**	**Per cent**
Farming	113	48.1
Trading/business	68	29.2
Civil/public servants	42	18.1
Commercial/industrial worker	7	3.2
Others	3	1.4
Total	**234**	**100.0**
Income of Respondents Per Month	**No. of Respondents**	**Per cent**
Less than 10, 000	123	52.7
11, 000-20, 000	89	38.0
21, 000-30, 000	19	8.1
30, 000 and Above	3	1.2
Total	**234**	**100.0**

Source: Fieldwork, 2018

4.2Information Needs of Farmers in the Niger-Delta

The information needs of farmers in the Niger-delta as gleaned from the in-depth interview are grouped under six headings: agricultural inputs; extension education; agricultural technology; agricultural credit; weather and climate and marketing. The information needs are all agriculturally related. This is understandably due to the fact that they are mainly farmers and are probably interested in information that would lead to increased productivity. This is similar to the findings of Wesseler and Brinkman. (2002) which asserted that information needs of farmers are centered around production. Farm inputs are needed to increase productivity. These inputs may include fertilizers, improved variety of seeds and seedlings, feeds, plant protection chemicals, agricultural machinery, and equipment and water. Extension workers play important roles in conveying information in a meaningful form to farmers. One of the ways they do this is by training a group of model farmers with the hope that such farmers come in contact with other farmers. The farmer needs information on production technology

that involves cultivating, fertilizing, pest control, weeding and harvesting as well as credit facilities and market opportunities for their produces. Another major information need is climate information that helps in determining planting and harvesting periods. Table 2 shows the sources of information and communication strategies among farmers in the Niger-Delta

Table 2: Sources of Information and Communication Strategies among Farmers in the Niger-Delta

Sources	Frequency	Percentage
Personal experience	42	17.9
Workshop/seminar	11	4.7
Friends and Neighbours	36	15.4
Ministry of Agric	30	12.8
Magazines	4	1.7
Newspapers	5	2.1
Extension officers	28	12.0
Local Government Offices	1	0.4
Non Government organizations	0	0.0
TV Broadcast	7	3.0
Radio Broadcast	12	5.1
Internet	2	0.9
Traditional Rulers/community leader	53	22.6
Journals	1	0.4
Libraries	1	0.4
Posters	1	0.4
Total	**234**	**100.0**

Source: Fieldwork, 2018

Table 2 shows that respondents obtain their information needs through multiple sources. The responses indicate that traditional rulers/community leaders topped the list, 53 (22.6%), followed by personal experiences 42 (17.9%). Friends and Neighbours accounts for 36 (15.4%), Ministry of Agric. 30 (12.8%), Extension Officers accounts for 28 (12.0%) and radio broadcast accounted for 5.1 per cent. It is pertinent to note that less than 1.0 per cent of the farmers indicated print and electronic media as sources of information as shown in the table above. In view of the above findings, the study examined the sources of climate information in the study area.

4.3 Sources of Climate Information in Nigeria

Using Shannon-Weaver model as the main framework of analysis, the study attempts to determine the main sources of climate information in the study area. Results indicate that the Nigerian Meteorological Agency (NIMET) has the mandate to monitor weather and climate in Nigeria and provide meteorological information for sustainable development and safety of life and property in the country. In response to this mandate therefore, the Agency produces the rainfall prediction annually and presents it as the Seasonal Rainfall Prediction (SRP) in the first quarter of every year. Apart from NIMET, academic institutions such as universities, non-governmental organizations and research institutions are other main sources of climate information in Nigeria. Some institutions created by the government such as Special Climate Change Unit (SCCU) within the Federal Ministry, Building the Nigerian Response to Climate Change (BNRCC), Nigerian Environmental Study/Action Team, among others also help in the dissemination of climate information. Some academic institutions have special centres dedicated to the provision of climate information such as the Centre for Climate Change and Fresh Water Resources at Federal University of Technology Minna and Centre for Energy, Research and Development at Obafemi Awolowo University Ile -Ife; and Abubakar Tafawa Balewa University, Bauchi respectively.

4.4 Encoder, Channel, and Noise in Climate Change Information Dissemination

The study further examines the formats for the dissemination of climate information in Nigeria. It is crucial to note that the format is a major factor that influences end-users ability to comprehend any information. Results indicate that the main formats are text, audio and digital or images. The text format is in English language while the audio is usually sound produce from speakers. While English language is the official text format in Nigeria, however, the literacy level of the local communities is a major determinant of their ability to interpret the text. Table 3 shows the main channels of climate change communication in Nigeria.

Table 3: Channels of Climate Change Communication in Nigeria

Channels of Climate Change Communication	Media
Mass Media	TV, Radio
Print media	Pamphlets, newspapers, brochures, posters
Electronic media	Internet, sms support services

Source: Fieldwork, 2018

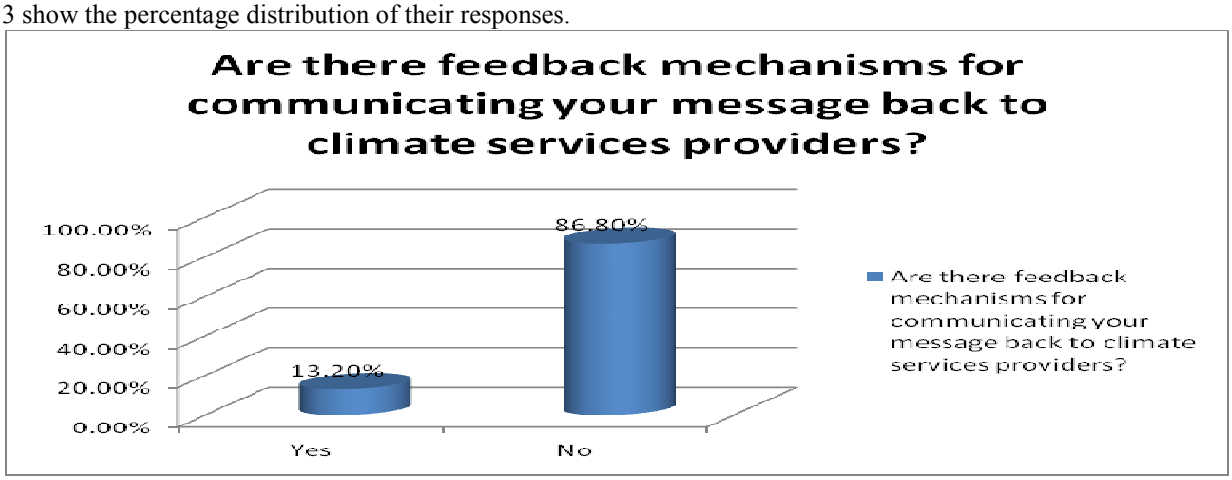
Table 3 indicates three main channels of climate change communication including mass media comprising television and radio. The second channel is the print media which includes newspapers, brochures, posters and pamphlets. The last channel is the electronic media including internet and sms support services. As noted by Lwoga et al, (2010), the use of ICT including internet, mobile phones, emails, community radio, TV, telecenters, computers are not fully utilized by community. What is obvious from the above table is the fact that the present channels of climate change communication lack indigenous or traditional content and thus at variance with the information sharing and communication strategies of farmers in the region as noted in Table 2. The implication of this is that local community in the Niger-delta region will lack access to climate information since climate information are not disseminated through community channels. The next important variable in the Shannon-weaver model is noise. Noise in the context of climate information dissemination refers to the language of communication. The use of technical terms in climate change information communication among services providers constitute noise and hinder proper understanding of messages by locals. A typical example is this excerpt taken from the NIMET seasonal rainfall prediction (SRP) 2013:

> *"The Prediction model is based on the strong teleconnection between El Nino/Southern Oscillations (ENSO), Sea Surface Temperature (SST) anomalies and rain-bearing weather systems over Nigeria... The 2013 SRP is based on the Neutral Phase of the ENSO phenomenon. Chances are high that the neutral phase will continue up to 2013 peak rainy season.The other ENSO phases, that is, La-Nina and ... (NIMET, 2013)".*

Decoding this type of message is difficult due to the high number of technical terms involved.

4.5 Feedback Mechanisms in Climate Change Communication

End-users of climate information are not just passive absorbers of messages; they receive the message and respond to them. Feedback is essential in climate change communication so as to know whether the end-user has understood the message in the same terms as intended by the sender and whether he agrees to that message or not. Feedback enables the source to evaluate the effectiveness of his message. If end-users do not understand the message, the source can tell by the feedback and then refine the message accordingly. In this context, the end-users in the study area were asked the extent to which to send feedback to climate information providers. Figure 3 show the percentage distribution of their responses.



Source: Fieldwork, 2018

Figure 3 indicates that more than 86 per ecnt of the respondents noted that there are no feedback mechanisms for communicating their responses back to the climate service providers. This lack of feedback mechanism only confirms several facts. Firstly is the fact that the channels of climate change information dissemination in the study area is not effective and hence hinders access to climate services among local communities in the study area. Secondly, is the fact that community channels are the dominant medium of accessing climate information in the study area. In the light of the above, it is important that community channels are mainstreamed into climate change information dissemination strategies in Nigeria. Consequently, the paper

proposes the following framework for climate information dissemination in the study area as shown in Figure 4.

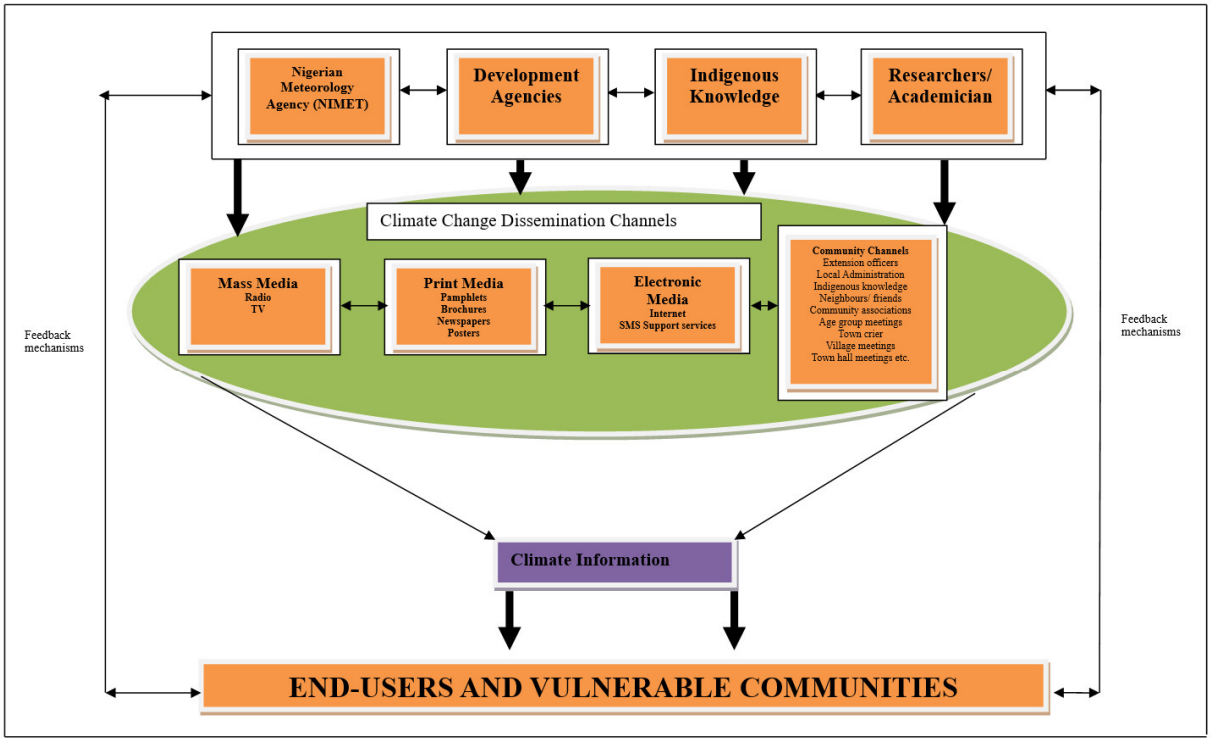


Figure 4: Framework for Climate Change Information Communication
Source: Author, 2018

The framework has certain unique features. The first of it is the interaction among the various sources of climate information and that of the various channels of climate information communication. This is important for knowledge and information sharing and will promote wider dissemination of climate information. Another unique feature is the mainstreaming of the community channel as a strategy of climate information dissemination. The incorporation of feedback mechanism is another unique feature of the framework.

4.6. Conclusion and Recommendations

The study shows that the information need of the farmers are agriculturally based and this was attributed to the fact that the respondent's livelihood is anchored on agriculture. The study further shows that community channel is the major source of accessing information in the study area and this is at variance with the channels of disseminating climate information in the study area. Beyond this and most critically, the study identified the absence of feedback mechanism in the existing framework for climate information dissemination. Based on the above findings, the study recommends the mainstreaming of community channels into the channels of climate information dissemination in the study area. In addition, adequate feedback mechanism should be established to ensure that information disseminated are not only received but interpreted and utilized accordingly.

References

Aleksandrova, M.; Gain, A.; Giupponi, C. (2015). Assessing agricultural systems vulnerability to climate change to inform adaptation planning: An application in Khorezm, Uzbekistan. *Mitig. Adapt. Strateg. Glob. Chang.* doi:10.1007/s11027-015-9655-y.

Apata T.G., Samuel, K.D., and Adeola, A.O, 2009. Analysis of Climate Change Perception and Adaptation among Arable Food Crop Farmers in South Western Nigeria. Contributed Paper prepared for presentation at the International Association of Agricultural Economists' 2009 Conference, Beijing, China, August 16-22,209

Ayubu J.C, Malongo R. S.M, Siza D.T, Respickius C (2012). Understanding Farmers Information Communication Strategies for Managing Climate Risks in Rural Semi-Arid Areas, Tanzania. *International Journal of Information and Communication Technology Research*,

Building Nigeria's Response to Climate Change (BNRCC), (2008): Annual Workshop of Nigerian Environmental Study Team (NEST): The Recent Global and Local Action on Climate Change, held at Hotel Millennium, Abuja, Nigeria; 8-9th October, 2008.

Lwoga, E.T., Ngulube, P. & Stilwell, C. (2010). 'Understanding indigenous knowledge: Bridging the knowledge gap through a knowledge creation model for agricultural development', *SA Journal of*

Information Management 12(1), Art. #436, 8 pages. DOI: 10.4102/sajim. v12i1.436

McMichael, A. J., D.H. Campbell-Lendrum, C.F. Corvalan, K.L. Ebi, A. Githeko, J.D. Scheraga, A. Wooward, (2003): Climate Change and Human Health- Risks and Responses, World Health Organization, Geneva

Muhammad Ateeq-Ur-Rehman, Badar Naseem Siddiqui, Naimatullah Hashmi, Khalid Masud, Muhammad Adeel, Muhammad Rameez Akram Khan, Khawaja Muhammad Dawood, Syed Ali

Asghar Shah, Madiha Karim (2018): Climate Change Impact on Rural Livelihoods of Small Landholder: A Case of Rajanpur, Pakistan. *International Journal of Applied Agricultural Sciences*. Vol. 4, No. 2, 2018, pp. 28-34.

Nigerian Environmental Study Team (NEST), 2004; Regional Climate Modelling and Climate Scenarios Development in Support of Vulnerability and Adaptation Studies: Outcome of Regional Climate Modeling Efforts over Nigeria, NEST, Ibadan, Nigeria

Nyenzi, B and Malone, L (2005): Challenges of Climate Prediction and its Application to the Agriculture Sector. Accessed 20th September from https://www.wmo.int/pages/.../mod5_climate_pred_apps_ag_sector.doc

P. Suarez, (2009). "Linking climate knowledge and decisions: humanitarian challenges," *The Pardee Papers* 7, pp. 44-57

Patz, J.A., 2002: A human disease indicator for the effects of recent global climate change, Proc. National Academy of Science. USA, 99, No. 20, 12506 – 12508

Powell, C. B., White, S. A.; Ibiebele, D. O; Bara, M; Dut Kwicz, B; isoun, M. Oteogbu, F. U. (1985) Oshika *Oil Spill Environmental Impact; effect on Aquatic biology*. Paper presented at NNPC/FMHE International Seminar on petroleum industry and the Nigerian Environment 11 – 13 Nov. 1985, Kaduna, Nigeria 168 – 178.

Sejabaledi, R (2016). Perceptions of Climate Change and the Potential for Adaptation in a Rural Community in Limpopo Province, South Africa, *Sustainability* vol: 8 issue: 8 672-682

Shannon, C. E. & Weaver, W. (1949): The Mathematical Theory of Communication, Urbana, University of Illinois Press.

Tall A, Mason, S.J, van Aalst, M, Suarez, P. Ait-Chellouche Y, Diallo, A.A and Braman L (2012): Using Seasonal Climate Forecasts to Guide Disaster Management: The Red Cross Experience during the 2008 West Africa Floods, *International Journal of Geophysics,* Volume 2 No. 11, pp. 838-845