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Constraints to Access and Utilization of Meteorological Services in Delta State, Nigeria

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Abstract: Climate change effect on agricultural productivity is very glaring. There is an advocacy for arable crops farmers to take advantage of the Nigeria meteorological services (NIMET) as part of adaptation strategies against climate change. Having an insight into the constraints to access and utilization agro-meteorological services is worthwhile for agricultural extension programme planning. This study evaluated assessed the constraint to access and utilization of agro-meteorological service among arable crop farmers in Delta State Nigeria. The agro-meteorological services that were most made available to them ranged from daily weather forecast to seasonal weather condition. The farmers mostly accessed and utilized daily weather forecast, seasonal rainfall prediction, information on crop stages performance and general weather condition. However, untimely release and transmission of the needed information was the major constraint to utilization of agro-meteorological services. The farmers' socioeconomic attributes such as level of formal education, household size, farm size, extension contact and membership of farmers' association influenced the utilization of agro-meteorological services. It is concluded that the level of access to and utilization of agro-meteorological services is low as a result of the constraints experienced by the farmers. It was recommended that agro-meteorological services information need to be disseminated timely and the information be simplified before dissemination to farmers.

Delta Eyaleti, Nijerya'da Meteoroloji Hizmetlerine Erişim ve Kullanım Kısıtlamaları

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Anahtar kelimeler

Adaptasyon stratejileri,
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Öz: İklim değişikliğinin tarımsal verimlilik üzerindeki etkisi çok dikkat çekicidir. Ekilebilir mahsülçiftçilerinin, iklim değişikliğine karşı uyum stratejilerinin bir parçası olarak Nijerya meteoroloji hizmetlerinden (NIMET) yararlanmaları savunuculmaktadır. Tarımsal meteoroloji hizmetlerine erişim ve kullanım kısıtlamalarına ilişkin bir kavrayışa sahip olmak, tarımsal yayım programı planlaması için faydalıdır. Bu çalışma, Delta Eyaleti Nijerya'daki ekilebilir mahsul çiftçileri arasında agro-meteoroloji hizmetine erişim ve kullanım kısıtlamasını değerlendirmiştir. En çok kendilerine sunulan agro-meteorolojik hizmetler, günlük hava durumu tahmini ile mevsimsel hava durumu arasında değişmektedir. Çiftçiler çoğunlukla günlük hava tahminlerine, mevsimsel yağış tahminlerine, ürün aşamalarının performansına ve genel hava durumuna ilişkin bilgilere erişmekte ve bunları kullanmaktadır. Bununla birlikte, ihtiyaç duyulan bilginin zamansız bir şekilde yayınlanması ve iletilmesi, tarımsal meteoroloji hizmetlerinin kullanımının önündeki en büyük engeli oluşturmaktadır. Çiftçilerin resmi eğitim seviyesi, hane büyüklüğü, çiftlik büyüklüğü, tarımsal yayım teması ve çiftçiler birliğine üyeliği gibi sosyoekonomik özellikleri, agro-meteorolojik hizmetlerin kullanımını etkilemektedir. Çiftçilerin yaşadığı kısıtlamalar nedeniyle tarımsal meteorolojik hizmetlere erişim ve kullanım seviyesinin düşük olduğu sonucuna varılmıştır. Tarımsal meteoroloji hizmetleri bilgilerinin zamanında dağıtılması ve bilginin çiftçilere dağıtılmadan önce basitleştirilmesi önerilmektedir.

1.Introduction

The contribution of agriculture to the Gross National Product (GDP) of Nigeria cannot be over emphasized. Most of the rural dwellers are engaged in agricultural livelihood activities. Agricultural production depends on climatic factors apart from other factors. This implies that minor negative changes in climate are capable of prompting damaging socioeconomic outcomes of agricultural activities. Thomas and Sanyaolu (2017) suggest that the fourth assessment report for Africa by intergovernmental panel on climate change (IPCC) indicates that the warming trend is faster than the global average and increasing rate of arid land formation in many countries. IPCC (2007) suggests that climate change impacts a catalogue of stresses on the social, biophysical and institutional environments that control agricultural production.

Effect of climate change on agriculture is highly pronounced through the accompanying result on the socioeconomic and environment related aspects of rural dwellers' lives, as they are primarily engaged in agricultural activities for their livelihood. Thomas and Sanyaolu (2017) describe the Biophysical impacts as including physiological effects on livestock and crops, change in water, soil and land resources, rise in sea level and transformations in salinity of the various ranges. The socioeconomic impacts have consequences of reducing the marginal GDP from agriculture, promoting world market price fluctuation, encouraging shifts in trade regime, alter geographical distribution, increase population of the vulnerable who are at hunger and food insecurity risk, civil unrest and migration (Thomas and Sanyaolu, 2017). While supporting this assertion van der Zaag (2010) states that yields of grains became stagnant in African countries as a result of temporal variation and inconsistency in the pattern of rainfall which was experienced in 2012, that also witnessed the flooding of cassava, maize, yam and rice farms in Delta, Edo, Oyo and Adamawa States. The results are that the progressively increasing severity and frequency of droughts are most likely to give rise to crop failure, forced sales of livestock, high and appreciating cost of food, impoverishment, de-capitalisation and eventually, famine (Thomas and Sanyaolu (2017). These are some of the challenges of farmers that agricultural extension functions to obliterate and guide the farmers to raise their standard of life.

Nigeria currently experiences adverse climate conditions resulting to unpalatable effects on the well-being of a bulk of the population of farmers. Cropping seasons have been altered by off-season rainfalls, persisting draught, flood and long dry spells. This development attracted the attention of Agricultural Development and Rural Development Agency (the public agricultural and rural extension agency). This informed the Delta Agricultural and Rural Development Agency to organize workshops for farmers and most of the ones held in the last three years dwelt on access and utilization of weather reports (Thomas and Sanyolu, 2017). Most of the farmers always receive agro-meteorological information through extension agents, and extension messages over the radio, farmers' associations, other farmers and friends, and on television. One of the adaptation strategies to climate change advocated by the Delta Agricultural and Rural Development Agency (DARDA) is the utilization of the services of Nigeria Meteorological Agency (NIMET). NIMET was established among other stakeholders, to serve and guide agricultural activities. The major purpose includes provision of weather, climate and precipitation information. It has the mandates of ensuring international best standard practices maintenance in every area which includes promotion of services needed in agricultural practices, prediction of early season weather storm, prediction of rainfall, prediction of direction of wind and sensitisation of farmers on the warnings of uncontrollable weather conditions (Thomas and Sanyaolu, 2017).

Rogers' diffusion of innovation theory is of the assumption that four factors including the innovation or information or idea; channel of communication; the social system and time determine the rate of diffusion. Access to and utilization of innovations, ideas and information depend on these elements. A little problem in one or more of these factors can mar farmers' access to and utilization of such information, ideas and technologies. The constraint to access and utilize of meteorological service may be prompted by one or more of these elements of diffusion. In another development, Rogers (1975) protection motivation theory (PMT) proposes a process of coping appraisal, whereby behavioural alternatives to reduce or obliterate threat are evaluated. The theory proposes that an individual's intention to protect him or herself rests on four variables. These variables include the severity of the threatened event (for example loss of agricultural investment); perceived vulnerability of individuals to effects of climate change; the efficacy of recommended prevention behaviour (adoption of climate change adaptation strategies) and perceived self-efficacy. These variables are expected to motivate the farmers to seek to access and utilize meteorological services knowing that being armed with the information from these services will protect him against the threat of climate change effects. This will propel the farmers to want to access and utilize such climate services. Attempts were made to mainstream climate services through sectoral development strategies to ensure improvement in adaptive capacities of farmers (Naab and Ahmed, 2019). This is important as according to Naab and Ahmed (2019), mainstreaming climate services needs to be at the fore front of ensuring a resilient agricultural base.

Various scholars in their studies already convinced the world on the effects of climate change on various arable crops. Onyegbula (2015) is the chronicler of rice farmers' strategies for adaptation to climate change in Nigeria, while Tella (2016) studied and conducted analysis on livelihood and coping mechanisms to climate change among rural women in North-eastern region of Nigeria; Ofuoku et al. (2011) studied the adaptation to climate change in Edo State and found that the most important constraint to climate change adaptation is lack of access to meteorological information- weather forecast. The public agricultural extension agency (DARDA), as a one of the strategies for adaptation to climate change, encourages farmers to utilize weather/ climate information from NIMET. It is the expectation of the extension agency that these farmers took advantage of NIMET's agro-meteorological information. However, Ofuoku (2017) found that most arable crop farmers either could not access or experience difficulty accessing agro-meteorological information. These farmers incurred some crop losses as a result of lack of access to climate change- related information (Adejuwon, 2004). Arising from the afore mentioned findings, this study was articulated to identify the constraint to access and utilisation of agro-meteorological information.

1.2. Objectives of the study

This study was articulated to identify the constraints to access and utilization of meteorological services among arable crop farmers in Delta State, Nigeria.

1.3. Hypothesis

Ho_1: The socioeconomic attributes of farmers do not significantly influence their level of utilization of meteorological services.

2. Material and Methods

2.1. Study area

The study was conducted in Delta State, Nigeria. The state is located in the co-ordinate of longitudes $5^0$00and $6^0$45 East of the Greenwich Meridian and latitudes $5^0$00 and $6^0$30 north of the Equator. It is under mangrove, swamp, freshwater and rainforests and derived savannah vegetative cover. It is demarcated into three agricultural zones, namely Delta South, Delta North and Delta Central Agricultural zones by the then Delta State Agricultural Development programme (DTADP) (Ofuoku and Ekorhi-Robinson 2018; Ofuoku et al., 2019; Ofuoku, 2019).

Delta State has a tropical climate with annual precipitation of about 300cm and temperature range between 26^0C and 32^0C and it is characterized by rainy season which lasts from late March to October and a dry season from November to Mid-March (NIMET, 2012). The climate conditions of the state favours the production of arable and tree crops such as maize, cassava, yam, plantain, cocoa, oil palm, rubber, among others. There has been frequent variability of weather which were manifested as continual increase in temperature, humidity, cloud cover and precipitation. This is contained in the report of MIMET (2016) in which Delta State was mentioned as one of the eleven states of Nigeria that is susceptible to flooding as a consequence of meteorological reportage in which an increased rate of rainfall in the States was predicted.

2.2. Population and sampling method

All arable crop farmers and NIMET zonal director in Delta State constitute the study population. Multistage sampling procedure was used to select the respondents for this study. The 25 local government (LGAs) which constitute the state were stratified into Delta North, Delta Central and Delta South Agricultural zones. At the first stage, simple random sampling method was used to select Ukwuani, Ethiope West and Patani LGAs from Delta North, Delta Central and Delta South Agricultural zones respectively. The list of arable crop farmers was accessed from the DARDA offices in the selected LGAs and 10% of the population was selected randomly to have a sample size of 220 farming. The 3 zonal directors in the agricultural zones were also selected.

2.3. Data collection

Quantitative data used for the study were collected from the farmers using interview schedule and questionnaire. While quantitative data were collected through interview with the 3 NIMET zonal directors. Two hundred and twenty (220) copies of interview schedule and questionnaire were administered; however, 212 copies could be retrieved and were used for this study. The instruments for data collection asked question relating to the socioeconomic characteristics of the farmers; available meteorological services; access to these services; level of utilization of the services; and constraints to access and utilization of agrometeorological services.

2.4. Data analysis

Objectives i,ii,and iii were achieved by the use of frequency counts and percentages. Objectives iv and v were met with the application of means derived from 4-point likert-type scale. Hypothesis 1 was tested with the using a probit regression model as shown below

2.4.1. Analytical framework for estimating the determinants of utilization of meteorological services

The utilization of meteorological service by farmers was modelled as a climate change adaptation decision-making process which takes root in the utility maximization theory (Klair and Richardson, 1998), where a farmer utilizes the available meteorological services only when the utility obtained from adopting the service information is greater than the utility he expects to obtain from not utilizing it. As a Consequence, this decision takes a binary form which involve two mutually exclusive alternatives. The farmer either utilizes the meteorological services or does not. This results to a binary dependent variable, *Yi*, which takes on the values of 0 if he/she does not utilize the meteorological services accessed and 1 if the meteorological services are utilized. Hence, to observe a value of 1 is going to result in the probability,

$$Pr = (Y_i = 1/x_{i\beta i}) = 1 - F(-x_{i\ \beta i}) \qquad (1)$$

and that for observing 0 is given by,

$$Pr = (Y_i = 0/x_{i\ \beta i}) = F(-x_{i\ \beta i}) \qquad (2)$$

where *F* is a continuous and strictly increasing cumulative distribution function, which takes a real value and returns a value which ranges from 0 to 1.

Consequently, the parameters captured in the models in Equations. (1) and (2) are achieved by using the maximum likelihood estimation approach. The dependent variable is an unobserved covert variable that has relationship with *Yi* as

$Yi = \beta jXji + \delta i$ (3)

where δi is a arbitrary disturbance term.
The observed dependent variable is determined by whether the predicted Y_i* is greater than 1 or otherwise:

$Yi = 1$ if $Y_i^* > 0$ and $Yi = 0$ if $Y_i^* \leq 0$ (4)

where Y_i^* is the threshold value for *Yi* and it is assumed to be a normal distribution.

Taking cue from Madala (2005), the probit model that was adopted for this study is specified as follows:

$Pi = P(Y_i^* < Y_i) = P_i = P(Y_i^* < \beta 0 + \beta j X_{ji})$ (5)

where *Pi* is the probability that an individual farmer is going to make a certain choice (to utilize the meteorological service received or not) and *Yi* is the dependent variable.

2.4.1.1. The empirical model

The empirical model is explicitly specified as:

$$Pri(Iuse i = 1|x) = \alpha_0 + \sum_{J=1}^{5} \alpha H_{,j} H_{k,i} + \sum_{J=1}^{3} \beta X_{,j} X_{j,I} + \sum_{J=1}^{5} \alpha I_{,j} I_{j,i} \quad (6)$$

where Hj,i is a set of covariates that stand for the characteristics of the sampled household heads and their respective socioeconomic situations; Xj,i represents farm-level factors; Ij,i represents the set of institutional covariates of the arable crop farmers.
Y = Utilization (utilized=1, otherwise=0);
X_1 = age (years);
X_3 = Sex (male = 1, Female =0);
X_4 = Marital status (married = 1 otherwise = 0);
X_5 = level of formal education (number of years of schooling);
X_6 = Household size (number of persons);
X_7 = farm size (hectares);
X_8= Extension contact (number of times);
X_9 = Membership of farmers' association (yes = 1, no = 0)

3. Results

3.1. Available Agro-meteorological services

The major services made available to the farmers by NIMET included (75.94%); seasonal rainfall prediction (75.94%); information on general weather situation (61.79%) and information on crop performance stages (57.08%) (Table 1). With respect to daily weather forecast, 49.53% opined that such information get to them. Sensitization and training workshop on climate change were organized by NIMET as affirmed by 41.04% of them. Some (41.04%) of them also affirmed that NIMET gave them prediction of potential flood. Information on soil moisture indices were also made available to them by NIMET as asserted by 34.91% of them. Many (42.92%) opined that early information on warming and preparedness strategy was also given to them.
Table 1. Available agro-meteorological services

Agro-Meteorological Services	Frequency	Percentage(%)
Wind direction	155	25.94
Daily weather forecast	105	49.53
Seasonal rainfall prediction	161	75.94
Indices of soil moisture	74	34.91
Crop performance stages information	121	57.08
General weather situation	131	61.79
Sensitization and training workshop on climate change	87	41.04
Prediction of potential flood	87	41.04
Climate field school	36	16.98
Early warning information and preparedness strategy	91	42.92

There were multiple responses.

Overall availability of agro-meteorological services was poor as (32.08%) of the farmers suggested that prediction of drought was also disseminated. The level of transmission of wind direction information to them was poor as only 25.94% of the farmers indicated that such was transmitted. Very few (16.98%) of them were of the opinion that climate field school was organized for them. This is adjuged to be below expectation. Similar trend was found by Naab and Ahmed (1019) in Ghana and by Thomas and Sanyaolu (2017) in Oyo State, Nigeria.

3.2. Communication channels employed in carriage of agro-meteorological services to farmers

There is an indication in Table 2 that slightly more than half (57.23%) of the arable crop farmers always received agro-meteorological messages information from extension officers of Delta Agricultural and Rural Development Agency (DARDA). Slightly more than half (55.0%) of them also accessed agro-meteorological information through radio always. A little less than half (46.23%) relied on other farmers and friends to access agro-meteorological information always. Some (40.0%) of them accessed information through television always. Similar channels were used in Ghana to render meteorological services to farmers (Naab and Ahmed, 2019). Thomas and Sanyaolu (2017) also found that same channels were used in Oyo state, Nigeria.

Table 2. Communication channel of rendition of agro-meteorological services

Channels	Always(%)	Occasionally (%)	Used(%)
Extension agents (DARDA)	57.23	5.03	37.74
Association	47.23	15.03	37.74
Other farmers/friends	46.23	36.32	17.45
Radio	55.0	26.30	18.70
Television	40.0	52.30	7.70
Newspaper	15.80	32.70	51.50
Internet	6.91	13.53	79.56

There were multiple responses

3.3. Arable crop farmers’ accessibility to agro-meteorological services

Over half (52.83%) had daily access weather forecast; half of them (50.0%) could access prediction on seasonal rainfall (Table 3). Half (50.0%) of them were able to access crop performance stages information, 51.89% had access to general weather condition. Few (21.70%) affirmed that they had opportunity to attend sensitization and training workshop on climate change, while 2.28% accessed prediction on potential flood vary few (16.04%) claimed that they received early warning messages and information on preparedness strategy. While 14.62% accessed prediction on drought. Very few (15.09%) received information on soil moisture indices and 10.38% attended climate field school as 9.91% received information on mind direction. Stone and Meinke (2006) suggest that arable crop farmers accessed daily weather forecast, seasonal rainfall prediction, and general weather conditions more than the other services. However Thomas and Sanyaolu (2017) found a similar trend among farmers in Oyo State, Nigeria.

Table 3. Accessibility of farmers to agro-meteorological services

	Frequency	Percentage(%)
Daily weather forecast	112	52.83
Seasonal rainfall prediction	106	50.0
Wind direction	21	9.91
Information on crop stages performance	106	50.0
General weather condition	110	51.89
Soil moisture indices	32	15.09
Prediction of drought	31	14.62
Prediction on potential flood	43	20.28
Sensitization and training workshops on climate change	46	21.80
Early warning messages and preparedness strategy	34	16.04
Climate field school	22	10.38

3.4. Utilization of agro-meteorological services

Most (mean = 2.61) of the arable crop farmers utilized meteorological information on daily weather forecast (Table 4), many of their utilized information on seasonal rainfall prediction (mean = 2.50) and information on crop stages performance (mean = 2.50). Likewise, many of them used information on general weather condition (mean= 2.53). Their usages of wind direction (mean = 0.81), soil moisture indices (mean = 1.11), prediction on drought (mean = 1.09), prediction on potential flood (mean = 2.06), sensitization and training workshop on climate change (mean = 2.06), sensitization and training workshop on climate change (mean =2.08) early warning messages and preparedness strategy (mean = 2.10) and climate field school (mean = 1.83) were less. The utilization index was 0.48, implying that over all 48% of the farmers utilized the information on agro-meteorological services. Thus performance is below expectation. This affirms Tarchiani et al’s (2018) findings that smallholder farmers in West Africa use similar meteorological services.

Table 4: utilization of agro-meteorological services

Agro-meteorological services	Mean	SD	Rank
Daily weather forecast	2.61	0.75	1st
Seasonal rainfall prediction	2.50	0.69	3rd
Wind direction	0.8	0.43	11th
Information on crop stages performance	2.50	0.75	3rd
General weather condition	2.53	0.68	2nd
Soil moisture indices	1.11	0.62	9th
Prediction of drought	1.09	0.68	10th
Prediction on potential flood	2.06	0.61	7th
Sensitization and training workshops on climate change	2.08	0.52	6th
Early warning messages and preparedness strategy	2.10	0.71	5th
Climate field school	1.83	0.67	8th

Cut-off mean = 2.50 Total mean = 21.22.
Grand mean score of utilization = 1.93.
Utilization index = 0.48.

3.5. Constraints to access and utilization of agro-meteorological services

The major constraint to utilization of agro-meteorological services the arable crop farmers contended with was untimely release and transmission of information (Table 5). Though the other constraints were there they were not regarded as being important or serious constraints. This finding is in consonance with that of Thomas and Sanyaolu (2017).

Table 5. Constraint to access and utilization of agro-ecological services

Constraint	Mean	SD	Rank
Dearth of accurate agro-meteorological information	2.09	0.86	5th
Too technical to apply	2.26	0.63	2nd
Irrelevant information	1.61	0.45	8th
High cost of access to information	2.22	0.51	4th
Information untimely	2.57	0.83	1st
Lack of interest access	2.25	0.64	3rd
Time consuming nature of service usage	1.82	0.22	6th
Lack of formal education	1.78	0.31	7th

3.6. Influence of socioeconomic attributes on utilization of agro-meteorological services

Table 6 indicates the probit result of the influence of socioeconomic attributes on selected meteorological services. (Table6). The results show that the socioeconomic attributes considered had varying influence on the utilization of the selected meteorological services. The utilization of one meteorological service, prediction of potential flood was influenced by gender and was significant at 5%. The magnitude of the influence was 18.33. This implies that male farmers were more disposed to utilization of prediction on potential floods. Formal education had significant influence on utilization of the selected meteorological services at varying degrees and levels of significance – daily weather forecast was influenced by education at the magnitude of 31.91 (1% level); seasonal rainfall, 25.08 (5% level); general weather situation, 02.25 (5% level); and prediction of potential flood 18.33 (5% level). That the magnitude of the influence of education on daily weather forecast is highest is attributed to the fact that the more formally educated farmers tend to listen more on daily basis for such information because of the value they placed on such information. Marital status likewise had significant influence on the four selected meteorological services all at 5% level, but at varying magnitudes. The magnitude of the influence on daily weather forecast was -34.94; seasonal rainfall prediction was -32.95; general weather condition was -05.81; and on prediction of potential flood was -0.0728. the magnitude of the influence was highest on utilization of general weather condition. The negative sign borne by the coefficients indicate that singles had more time to utilize the services than the married arable crop farmers. Household size had significant influence on utilization of general weather condition at 5% level and the degree of the influence was 01.50. It implies that farmers with large household sizes were more disposed to utilizing this service.

Farm size had significant influence on daily weather forecast at 10% level and the degree of influence was 03.17. Though the influence is a weak one, implying that farm size was not very important consideration in farmers' decision to utilize daily weather forecast.

Table 6. Probit estimates of the influence of selected socioeconomic attributes on meteorological service utilization among arable crop farmers

Variables	Types of information utilization among rice farmers							
	Daily weather forecast		Seasonal rainfall Prediction		General weather situation		Prediction of potential flood	
	ME	SE	ME	SE	ME	SE	ME	SE
Age	0.0268	0.0274	0.0304	0.0256	0.0210	0.0266	0.0245	.0255
Age2	−0.0002	0.0002	−0.0002	0.0002	−0.0002	−0.0002	−0.0002	−0.0002
Gender	− 0.0601	0.0966	.0664 0.0754	0.0944	−0.0055	0.1084	0.1833**	0.105
Education	0.3191***	0.0771	0.2508**	0.0722	0.0225**	0.0109	0.0581**	0.0277
Marital status	−0.3494**	0.1825	−0.3295**	0.1759	−0.0581**	0.0288	−0.0728**	0.0330
Household size	0.0071	0.0066	0.0006	0.0058	0.0150**	0.0072	0.0001	0.0050
farm size	0.0317*	0.0169	0.0144	0.0145	0.0158	0.0175	0.0311	0.0200
Extension contact	0.3350***	0.0169	0.3909***	0.0881	0.3763**	0.1018	0.2549**	0.1015
Membership	0.0004**	0.0002	0.2556	0.0827	0.0944	0.1002	−0.0855	0.1379
Experience	0.1756***	0.0589	0.0156**	0.006	0.0546***	0.0186	0.2999***	0.1085

Extension contact also had significant influence on utilization of daily weather forecast and seasonal rainfall prediction at 1% level and with magnitudes of 33.50 and 39.09 respectively. Extension contact also had significant influence on farmers' decision utilize information on general weather condition and prediction of potential flood all at 5% level and with magnitudes of 37.63 and

25.49 respectively. Membership of farmers' associations significantly influenced the farmers' decision to utilize daily weather forecast at 5% level. The magnitude of the influence was very weak, 0.04. Farming experience had significant influence on the farmers' decision to utilize all the meteorological services at different levels. It influenced utilization of daily weather forecast, general weather condition and prediction of potential flood at 1% level. The magnitudes of its influence were 17.56; 05.46 and 29.99 respectively. Experience in farming also influenced the farmers' decision to utilize seasonal rainfall prediction at 5% level, with a magnitude of 01.56. Past experience may have taught the farmers to utilize the meteorological services. These findings confirms those of Thomas and Sanyaolu (2017), Acheampong et al. (2017).

4. Discussion and Conclusion

The level of availability of agro-meteorological services to farmers was low. Though farmers claimed to be knowledgeable about climate change, the level of information accessed from NIMET agro-meteorological services was low. This assertion is in consonance with Roudier et al (2014) who found that farmers in Nigeria have the awareness of climate change, which they found to be manifesting in the dynamics in intensity of rainfall and distribution, increased temperature range and decline in soil fertility.

Most of the farmers always received agro-meteorological information through extension agents, radio, farmers' associations, other farmers and friends, and television. The result is indicative of the fact that extension agents of Delta Agricultural and Rural Development Agency largely disseminated agro-meteorological information to farmers. This was mostly done through extension agents meeting with farmers association Agbamu (2011) opine that as a consequence of the dearth of extension agents, extension-farmers interaction mostly takes place in groups or farmers' associations. Frequent extension farmers interaction is therefore expected to enhance technical competence of farmers in the agro-meteorological services need by them to adapt to climate change as confirmed by Adebayo et al (2012), regular contact between extension agents and farmers could enhance technology adoption. Radio has the widest coverage, out of all the electronic media of communication. This is because radio forms the cheapest electronic set, hence very affordable to rural dwellers and it is operated powered by batteries. This makes it very popular among rural dwellers who have irregular electricity supply. Farmers and friends of the farmers trade ideas and experiences among themselves when they meet. Adebayo and Adedoyin (2011) affirm that radio has the widest coverage as a medium of mass communication and it is very popular because of the simplicity of its operation. Motha and Stefanski (2006) assert that weather and climate information form data-rich products from diverse government agencies that offer basic ongoing information to farmers, and farmers' organizations through agricultural extension and advisory services.

The results on accessibility to meteorological services are indicative of poor access to agro-meteorological services among arable crop farmers. The implication is that arable crop farmers will not be able to put up timely response and adaptation strategies needed to cope with the effects of climate change. European commission (2009) IPCC 92012 suggest that this situation has adverse implication for food security through decreasing yields of crops, that will consequently lead to increased food price which will eventually push the population to alter production and consumption patterns.

The utilization of agro-meteorological services fell below expectation. This implies that the agro-meteorological services have not been fully used. The situation may have been prompted by the challenges associated with their usage in relation to late or untimely transmission of the messages by NIMET. Knowledge acquired can translate to functions alteration of operations only when it is disseminated or shared timely to the users (Asenso-Okkyere and Davis, 2009). This level of usage of these agro-meteorological services is not encouraging, considering the effect of climate change on agricultural productivity. Untimely release and dissemination of information is the major constraints to utilization of agro-meteorological services. Timeliness, of information, accessibility, adequacy and effectiveness of climate change information are crucial to agricultural enterprise planning. They are the hallmark of agriculture extension service delivery. This is more so when it is remembered that agricultural activities are time-bound and competency based. In the presence of the afore mentioned qualities, farmers will be guided better on the most appropriate or appropriate adaptation method or technique to use. Information relating to climate change is very crucial to climate change adaptation (Anselm and Tafeeq, 2010; Ann et al, 2013). However, while considering the amount of weather and climate information that are currently available for farmers, some kinds of information being developed or already in operation, especially climate forecasting and formation may be not well suited for use by farmers in their decision making process (Stone and Meinke,2006).

The socioeconomic attributes of the respondents positively influenced their level of utilization of agro-meteorological service. The implication is that a unit increase in each of the variables has the likelihood of leading to a unit increase in their level of utilization of agro-meteorological services. The higher the level of formal education, the higher their level of agro-meteorological services will be. Meaning that those with higher level of formal education modify one's attitude towards innovations (Salau et al, 2013). Formal education also contributes to comprehension of meteorological information. Information becomes useless when not understood for application. Farmers with large household sizes had the likelihood to put up a higher utilization attitude towards agro-meteorological services. Similarly, farmers with large farm sizes would most likely utilize more of the meteorological services. This implies that large sized farming households more often than not, have more labour that are available for farming business, as larger sized farms will most likely seek information's on meteorological services, in order to reduce losses prompted by the effects of climate change to the barest minimum. Idrisa et al. (2006) found that household size and farm size of arable crop farmers influence their search for information. Farmers become intrinsically motivated when there is any factor that will jeopardise their productive efforts. This is when they tend to behave according to the assumptions of Rogers' protection motivation theory.

Extension contact is another variable of that influence utilization of agro-meteorological services. An increased frequent extension contact increase the farmers' tendency to utilize the information related to climate change adaptation. Increased extension contact has the consequence of leading to increased usage of agro-meteorological services. This is congruent with a priori expectation. This implies that frequent extension contacts increase the frequency of utilization of climate information for mitigation of climate change. Most times farmers become motivated to respect the opinion and advice of extension personnel, when they have frequent contacts with the farmers (Thomas and Sanyaolu, 2017). With encouragement from extension agents, there is more likelihood of utilizing meteorological services among the farmers.

Membership of farmers' association increases the chance of frequent extension contact. Frequent extension contact eventually leads to increased awareness and utilization of agro-meteorological services. This has ripple positive effect on the farmers' productivity. In such groups farmers share experiences, information and ideas. These farmers' groups or associations form a clearing house for knowledge. Farmers' group are most useful in situations where there is a poor ratio of extension staff to farm families, like it is the current situation in Delta State.

Daily weather forecast, seasonal rainfall prediction, information on crop stages performance and general weather condition were most available accessed and utilized agro-meteorological services. However, the rate of use of the agro-meteorological services was poor, as a result of untimely information delivered to the arable crop farmers by NIMET. The constraints to access and utilization of meteorological services are not serious, however, these range from lack of accurate meteorological information, complexity of meteorological information, irrelevant information dissemination, high cost of access to information, untimely information dissemination, lack of interest on the part of the farmers, time consuming nature of access to and utilization of the information to lack of reasonable level of formal education.

Socioeconomic attributes of the arable crop farmers influenced their decision to utilize meteorological services. These attributes include formal education, marital status, farm size, extension contact, membership of farmers' association and years of farming experience. The constraints to access and utilization of meteorological services may be minor according to the responses of the farmers, utilization of meteorological services remain poor and these constraints may be regarded as being fundamental to access to and utilization of meteorological services to adapt to climate change effects. In other words, the constraint of untimely dissemination of climate and weather information, being the major constraints the farmers contended with, is responsible for the low level of access and utilization of meteorological services. In light of the above, there is need to repeat this study in other states in Nigeria and in West Africa.

It is hence recommended that more advocacies to farmers to participate in agro-meteorological services be carried out. Participation promotes involvement of local actors in farming and elicits prompt monitoring activities which give assurance of timely dissemination of agro-meteorological information to arable crop farmers. This calls for the review of the climate change adaptation programme planning process.

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