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Analysis of the Nexus in Agricultural Insurance Welfare and Climate Change Adaptation Decision: Evidence from Nigeria

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Abstract: Despite the global emphasis on climate change financing, there is limited information on the status of insurance welfare on climate change adaptation decision in Nigeria. This study therefore, examined the nexus in agricultural insurance welfare and climate change adaptation decision in Edo State, Nigeria. A cluster sampling technique was used. Raw data were collected using questionnaire distributed to 192 farmers. Descriptive and inferential statistics were the analytical tools used for the study. The mean age was 43 years. About 62% were males. Majority (82.3%) of the respondents were married with an average family size of 7 members. Their average farming experience was 14 years. The respondents were educated with a mean farm size of 1.52 hectares. About 77% of the respondents do not belong to cooperative society. Most, (65.6%) of the agrarians did not have access to credit. The average annual income earned by farmers was ₦274 724 00. Findings showed that 76.0% of the growers had little access to agricultural insurance welfare. The outcome of the binary probit model indicated that educational level, years of farming, farm size, cooperative membership, land ownership status, access to credit and income level influence agricultural insurance welfare for climate change adaptation decision, while education, household size, access to credit, membership of cooperative, income and extension contact contributed to adaptation decision. It is recommended that Government should make provision for insurance welfare package for farmers for greater productivity.

Tarım Sigortaları Refahı ve İklim Değişikliğine Uyum Kararında Nexus Analizi: Nijerya Örneği

Öz: İklim değişikliğinin finansmanına küresel vurgu yapılmasına rağmen, Nijerya'da iklim değişikliğine uyum kararında sigorta refahının durumu hakkında sınırlı bilgi bulunmaktadır. Bu nedenle, bu çalışma Nijerya'nın Edo Eyaleti'nde tarım sigortası refahı ve iklim değişikliğine uyum kararındaki bağlantıyı incelemiştir. Bir küme örnekleme tekniği kullanılmıştır. Ham veriler 192 çiftçiye dağıtılan anket kullanılarak toplanmıştır. Tanımlayıcı ve çıkarımsal istatistikler çalışma için kullanılan analitik araçlardır. Yaş ortalaması 43 bulunmuştur. Yaklaşık% 62'si erkektir. Ankete katılanların çoğunluğu (% 82.3) evli olup, ortalama 7 kişilik bir aile boyutuna sahiptir. Ortalama tarım deneyimleri 14 yıl bulunmuştur. Katılımcılar ortalama 1.52 hektarlık bir çiftlikle eğitildiler. Ankete katılanların yaklaşık% 77'si kooperatif toplumuna ait bulunmamaktadır. Tarım işletmelerinin çoğunun (% 65.6) krediye erişimi bulunmamaktadır. Çiftçiler tarafından kazanılan yıllık ortalama gelir 274 724 00 ₦ olarak saptanmıştır.

Bulgular, yetiştiricilerin % 76.0'ının tarım sigortası refahına çok az erişimi olduğunu göstermiştir. İkili probit modelinin çıktıları, eğitim seviyesi, çiftçilik yılları, çiftlik büyüklüğü, kooperatif üyeliği, arazi mülkiyeti durumu, krediye erişim ve gelir düzeyinin iklim değişikliğine uyum kararında tarım sigortası refahını etkilediğini gösterirken, eğitim, hane halkı büyüklüğü, krediye erişim , kooperatif üyeliği, gelir ve yayım irtibatı uyum kararına katkıda bulunduğunu göstermektedir. Devletin daha fazla üretkenlik için çiftçilere sigorta refah paketi sağlaması önerilmektedir.

1. Introduction

Climate change, a worldwide environmental problem is negatively affecting sustainable development across the globe (de Amorim et al., 2018). It is a progressive increment in temperature, rainfall, sea level and in recurrence, magnitude and extent of severe climatic happenings like drought, flood, cyclone and storm surge (Davis et al., 2017; Mark and Bastidas-Arteaga, 2019,). The high level of sensitivity and poor improvising measure have been tied to tremendous dependence on natural resources, low per capita GDP and extreme poverty, little capacity to adjust financially and institutionally, and a lack of insurance (Shilalo, 2016). The susceptibility of African farmers to the consequences of change in the climate is expected to be worst in Nigeria (Ahmed et al., 2016), with low funding to agricultural investigation (Feola et al., 2015). The threats of dynamism of climate in Nigeria affect the entire agricultural sub-sector (livestock, crop production, agroforestry, agricultural products processing) (Gwambene et al., 2019).

Globally, various countries are devising means to managing the danger caused by or worsened by climate change. Insurance services are majorly utilized as medium to curtail this risk by individuals and organizations across most developed nations. The use of insurance is gaining momentum in emerging countries, particularly in emerging economies, although researchers are skeptical about the potency of insurance in helping developing countries reduce the uncertainty of intense events, which have such disastrous crash on national economies, citizen's livelihood and development. This paper considers the risk sharing and transmission know how of insurance as a way of addressing loss and damage in developing countries particularly those vulnerable to climate change.

Several proposition for insurance instruments have been presented and discussed in the climate intervention process. Recently, the Swiss Government strengthened previous requests by introducing a multi-lateral adaptation fund that will be expended on prohibition and insurance. Therefore a good management that provides incentives for risk control will encourage more farmers to acquire the climate change adaptation measures beyond their reach. Insurance agencies can provide pecuniary reparations for the risk victims to recuperate quickly from the disaster shocks. It is imperative for rural household to adapt and adjust their mean of securing the necessities of life due to the threat of current and expected climate variability. Elum et al. (2017) noted that the extent to which the negative consequences of climate change are experienced are largely influenced by the proportion of adjustment in response to climate change, which when absent, the consequences would be damaging to the agricultural sector, but with adaptation, exposure can be significantly reduced. For significant adjustment and mitigation, it is important for people to be aware and obtain necessary information on ways to addressing the challenge. Accessibility to information by rural households will increase their awareness and adjustment capacity. Information, the building block of knowledge is required for development (Weichselgartner and Pigeon, 2015).

The adaptation action that households undergo in responding to climate change hinge on the level of awareness and utilization of insurance welfare which will in turn improve the source of income of the farmers directly and indirectly. In doing that, decision making could help to manage risk resulting from various climatic sources for better investments towards using the most promising climate adaptation measures, thus achieving the best return for each naira spent. Individual farmers decision to adapt to change in climate is determined by climatic forces enclosed within the farm household and outer forces that impinge on the agricultural systems at large (Rajbhandari, 2015). Farmers because of the climatic and agricultural threats are faced with taking analytical decisions about farming, financial security and well-being that has long-term consequencies.

Climate change adaptation approaches according to Altieri and Nicholls (2017 are those techniques that the people used to cope with the various consequences climatic variation. Mase et al. (2017) describe adaptation behaviors as those behaviors that minimize the susceptibility of human and natural systems against predicted climate change effects. In agriculture, adaptation contributes to farmers achieving food, income and livelihood security goals with changing climatic and socio-economic conditions (Thornton et al., 2018). The climate change adaptation methods commonly used include; intensification of irrigation, crop diversification, multiple/intercropping, agro-forestry/afforestation, mulching, utilization of improved crop and livestock varieties that are suitable to drier conditions, increased seed rate, crop diversification, crop rotation, tree planting, mixed farming systems and alteration of planting dates.

Adaptation activities are considered more expensive to fund and need financial grant to set out, which among the climate financing instrument is hardly taken (Henstra, 2016). However, some of the reported challenges and factors affecting climate change adaptation include, access to weather information, cooperative societies, credit facilities, extension services, education, processing and storage facilities, age, sex, farm size, labour availability and poverty (Otum et al., 2019). Reports have exposed that currently, developed countries are more committed to global warming mitigation than adaptation. However, a complete climate finance program demands new instruments throughout the life of a project to ensure that threats are minimized and open plausible investment opportunities that guarantees project development, institutional and technical capacity, green/climate bonds and investment risk insurance (Adepelu, 2018). The domestic financial sector including development finance institutions, private banks, microcredit institutions and insurers are pivotal in developing permissive climate finance framework for Nigeria.

The primary aim of agricultural insurance is to protect against economic fall from decrease in predicted yields from agricultural products. Insurance has a wide coverage which includes farmers that involved in crops, livestock, fisheries and forestry products production in commercial and other insurance package. Policies, namely personal accident, fire, vehicles, machinery and public liability covers that can safeguard the farmers for greater productivity are essential for complete agricultural insurance program (Agbam, 2015). Agricultural insurance policies safeguard the farmer against unpredicted circumstances by way of indemnification.

Agricultural insurance can assist in obtaining credit, because it boosts the financial strength of farmers and other agents in the agricultural sector. To the degree that fiscal safety net for severe events plays a unique role in minimizing the effects of climate change. Market-base for insurance fees can communicate the inherent threat and assist farmers and governments better obtain and manage the fiscal consequences of natural disasters. Farmers can also obtain incentive to adjust to change in climate by actively engagng in agricultural insurance (example, by shifting from crops that are unviable in the medium term as a result of climate change). However, any fee reduction program that falsifies the risk-based premiums may communicate a wrong monetary incentives to farmers and hinder, or at least cause lag in the adaptation strategies. There are various ways in which insurance welfare scheme can assist in downsizing the consequences of climate change. Awareness of insurance welfare plays significant role by way of absorbing the shocks of climate change and encourage adaptation decision.

Previous studies exist that have shown the significance of climate change on adaptation. Essandoh-Yeddu (2018) studies in south west region of Nigeria asserted that climate change result to severe reductions in farm harvest and income, streams/rivers drying up, loss of grassland /flora and devastation of wildlife ecosystem. Limited studies exist for farm level adaptation systems in the rainforest zones of Africa. Otum et al., (2019) in their review work addressed the limitations of agricultural adaptation to climate change in Nigeria thus creating a gap for further empirical methodology to the study of this issue. Onyenekwe, (2018) studied climate change adaptation techniques by wetland farmers in the Niger Delta but did not covered insurance welfare as an issue. Ajala (2017) emphasized that most of the work on climate modelling concentrated on increasing an understanding of atmospheric changes and does not take cognizance of the type of constraints faced by farmers and no data was obtained to guide agricultural decision makers.

Coster and Adeoti (2015) studied mitigation strategies to impact of climate change in Nigeria and reported that age, monthly income; educational level and extension contacts influence climate change mitigation. Similarly, Ali and Erenstein (2017) conducted a study in Ghana and stressed that it is rather simple for rich farmers to adapt and manage changes in climatic variations than the poor who

make up majority of farmers in Nigeria. Ndem and Osondu (2018) studied risk sources and management strategies adopted by cassava farmers in Nigeria with no reference to insurance welfare awareness. These have left some void in research to be filled especially in the aspect of carrying out a more comprehensive study on insurance welfare awareness that will motivate adaptation decision of the farmers. Zougmoré et al. (2016) discussed effect of climatic variation and adaptation schemes on pastoralists, fishery and crop production in West Africa, but the study only reviewed literatures thus creating a gap for further pragmatic approaches to the study of this subject.

It should be well-known that insurance welfare are known to improve farmers livelihood; however, the details of these improvements, the level and speed of such changes are yet to be documented, hence the synergy between agricultural insurance welfare and climate change adaptation decision are not clearly stated and supported by empirical studies from Nigeria. There is, therefore, a need to improve on such findings in a more quantitative manner especially with regards to the link between agricultural insurance welfare and climate change adaptation decision for evidence based policy making.

The intention of this investigation was to present some empirical evidence of the link between agricultural insurance welfare and climate change adaptation decision in Edo State, Nigeria.
The specific goals are to :
i.   ascertain the socio-economic characteristics of crop farmers
ii.   describe the level of awareness of climate change among farmers
iii. ascertain farmers level of access to agricultural insurance welfare.
iv.   determine the effect of agricultural insurance welfare on climate change adaptation decision
v.   estimate factors influencing farmers climate change adaptation decision
vi.   identify adaptation measures that can help farmers reduce climate change effects
vii. identify the major constraints militating against farming household in climate change adaptation decision making

Research Hypothesis
H_O: There is no significant relationship between insurance welfare scheme and climate change adaptation decision among farmers
H_1: There is significant relationship between insurance welfare scheme and climate change adaptation decision among farmers

2. Materials and Methods

2.1. Area of study

The study was carried out in Edo State, Nigeria. It is situated in Latitude: 5.44°N and 7.34°N of the Greenwich and Longitude: 5.4°E and 6.43°E covering about a total land area of 19,794km²with 3,218,332 people (National Population Commission, 2006). The State has a tropical climate ranging from humid to sub-humid at different times in the year. Three distinct vegetation's (mangrove forest, fresh swamp and savannah vegetation) exist in the State. The average annual rainfall ranges between 127-152 cm and 252-254 cm in the State respectively, with normal temperature of 24°C - 33°C. Farming (predominantly small farm holders) is the major occupation, followed by trading, arts and crafts, brewing, cottage industry, and rubber processing and trading in the state.

2.2. Sampling technique and data collection

Multistage procedures were applied in the selection of the farmers for the investigation with the aid of questionnaire. The first stage was the purposive inclusion of the three agro-ecological zones of the State, namely, Edo South, Edo Central and Edo North to give have-wide coverage. Edo South zone is made up of seven Local Government Areas (LGAs), Edo Central has five LGAs and Edo North has six. This resulted to eighteen (18) LGAs. Secondly, eight, three and five communities were carefully chosen from Edo South, Edo Central and Edo North agro-ecological zones proportionally based on number of LGAs. Thirdly, the sample size of this study 192 was selected from 370 arable crop farmers who were registered with insurance companies using Taro Yamane sampling method as demonstrated below:

$$n = \frac{N}{1+N(e)^2}$$ (1)

Where,
n=sample size
N=population of the study
e=error estimated at 5%

$$n = \frac{370}{1+370(0.05)^2}$$

$$n = \frac{370}{1+370(0.0025)^2}$$

$$n = \frac{370}{1+0.925}$$

$$n = \frac{370}{1.925}$$

n=192 approximately

2.3. Method of data analysis

Data collected were analyzed with descriptive and inferential statistics. Objectives (i), (iii), (vi) and (vii) were achieved with descriptive statistics such as frequency, percentage, chart, line graphs, mean and standard deviation. Objective ii was achieved using 3-point Likert rating scale. Objectives iv and v were achieved using binary probit model.

2.4. Model Specification

    i.   Probit model for insurance welfare determinants

Since access to agricultural insurance welfare was obtained from a discrete choice question with Yes = (1) if insurance welfare is accessible or No = (0) if insurance welfare is inaccessible, binary probit model was engaged to achieve objective (4) determinants of access to insurance welfare in the study area.

The general form of the binary probit model is specified as:

$\Pr(Y=1/X)=\beta_0+\beta_1 age+\beta_2 gender+\beta_3 education+\beta_4 householdsize+\beta_5 fexperience+\beta_6 farmsize+\beta_7 farmearning + \beta_8 cooperative\ membership_+ \beta_9 income+\beta_3 landownership\ status +e$ -----------------------------(1)

Where:

Y = dichotomous probability estimate with 1, if farmers have access to insurance welfare and 0 if otherwise

β_0 = intercept

$\beta_{1,...}\beta_{10}$= coefficients of the independent variables

$X_{1,...}X_{10}$= determinants of access to insurance welfare

e = stochastic error term.

X_1= age of farmer (years)

X_2 = gender (dummy: male = 1, otherwise = 0)

X_3 = educational level (years)

X_4 = household size (number of persons)

X_5 = years of farming

X_6 = area of farm (hectare)

X_7 = access to credit (dummy: access to credit = 1, otherwise = 0)

X_8 = cooperative membership (dummy: membership of cooperative = 1, otherwise = 0)

X_9 = income level (₦)

X_{10} = land ownership status (rent = 1, partner =2, self-owned = 3)

    ii.   Probit model for adaptation decision determinants

Since household decision to adapt to climate was obtained from a discrete question with Yes = (1) if household decision to adjust to climatic changes is positive or 0 if otherwise, binary probit model was employed to achieve objective (5) estimate factors influencing climate change adaptation decision in the study area.

The explicit form of the binary probit model is specified as:

$Pr(Y=1/X)=\beta_0+\beta_1 age+\beta_2 gender+\beta_3 education+\beta_4 householdsize+\beta_5 fexperience+\beta_6 farmsize+\beta_7 income + \beta_8$ credit access $+ \beta_9$ extension contact $+ \beta_{10}$ cooperative membership $+e$ ------------------------- (2)

Where:

Y = dichotomous probability estimate with 1, if a farmer decide to adapt to climate change and 0 if otherwise

β_0 = intercept

$\beta_1,...\beta_{10}$= coefficients of the independent variables

$X_1,...X_{10}$= determinants of climate change adaptation decision making

e = stochastic error term.

X_1= age of farmer (years)

X_2 = gender (dummy: male = 1, otherwise = 0)

X_3 = educational level (years)

X_4 = household size (number of persons)

X_5 = farming experience (years)

X_6 = farm size (hectare)

X_7 = income level (₦)

X_8 = access to credit (dummy: access to credit = 1, otherwise = 0)

X_9= extension contact (number)

X_{10}= cooperative membership (dummy: membership of cooperative = 1, otherwise = 0)

3. Results

3.1. Socioeconomic Profile of Farmers

Table 1 presents the socioeconomic attributes of the respondents in the study area. The age distribution of the farmers showed that majority (42.7%) of them fell within 31- 40 years age bracket. This was followed by 40.6% representing farmers between 41-50 years age brackets. 14.6% of them fell within 51-60 years age bracket. Only 1% of the respondents were between 21-30 years and above 60 years respectively. The average age of the farmer computed was 43years. This is productive and active age. Farmers in this age category could be highly innovative and adoptive. They can take appropriate measures that mitigate the negative impact of climate change. This means that use of adaptation measures increase with age. This is in agreement with the findings of Mase et al (2017) who opined that age which goes with wisdom can positively influence the decision to use adaptation measures. Genders of household revealed that majority (62%) of them were male while the remaining 39 % were female. This indicated that majority farmers were male. High proportions (82.3 %) of them were married, 12.5 % of the respondents were single and about 3.6 % and 1.6 % were widowed and divorced respectively. Majority (48 %) had family size of 1-5 persons, followed by 32 % of them who had family size of 6-10 persons while 13% and 2% had 16-20 persons and about 2.1 % had household size of 21 and above. The mean family size was 7 persons. The result disclosed that 8.3% of the sampled farmers had no formal education, while the remaining 91.7% were schooled at varying degrees. Out of this 91.7% that had formal education, about 32.3% of them attended primary school, 49% attended secondary school while 10.4 % had higher education. Years spent on farming indicate that 53% of them had 1 to 10 years' experience. This was closely followed by 26% of the respondents who had between 11 to 20 years of farming experience. Moreover, 12% of them had farming experience of 21 to 30 years while 5% and 4 % of them had 31 to 40 years' experience and above 40 years farming experience respectively. The average year of farming experience was 14 years (Table 1). The result showed that 89.6 % of them cultivated farm size between 1.1 to 2.0 hectare(s) of land, followed by 7.3 % of farmers that cultivated farm size of 1ha and below. Only about 3.1 % of them cultivated farm size of 2.1 to 3.0 hectares. The average cultivated farm size was 1.52 hectares. Approximately 59% of farmers as found out in this study had an annual income level of less than ₦100 000. This was followed by 15.6 % of them that earned between ₦100 000 to ₦200 000 as well as another group (15.6 %) earning above ₦400 000 per annum respectively. Moreover, 5 % of the farmers had income level between ₦ 201,000 to ₦300 000 annually and about 4 % of farmers had annual income level between ₦ 301,000 to ₦400 000. The mean per annum income level was ₦274 724. The result on Cooperative society status showed that 77 % of them

do not belong to any cooperative society. Only 23 % of them actually belong to cooperative societies. Majority (66%) of them have no access to credit and only 34 % of them had access to credit.

Table 1. Socio-Economic Characteristics of Respondents (Field data, 2018).

Variables	Frequency	%age (%)	Mean
Age(years)			
21-30	2	1.0	
31-40	82	42.7	43years
41-50	78	40.6	
51-60	28	14.6	
Above 60	2	1.0	
Total	192	100.0	
Gender			
Female	74	38.5	
Male	118	61.5	
Total	192	100.0	
Marital status			
Married	158	82.3	
Singled	24	12.5	
Divorced	3	1.6	
Widowed	7	3.6	
Total	192	100.0	
Household size			
1-5	92	47.9	
6-10	62	32.3	
11-15	24	12.5	7 persons
16-20	10	5.2	
21 and Above	4	2.1	
Total	192	100.0	
Level of Education			
No formal Education	16	8.3	
Primary School Edu	62	32.3	
Secondary school Edu	94	49.0	Secondary education
Tertiary Institution	20	10.4	
Total	192	100.0	
Experience			
1-10	102	53.1	
11-20	50	26.0	
21-30	22	11.5	14 years
31-40	10	5.2	
Above 40	8	4.2	
Total	192	100.0	
Farm Size Cultivated (ha)			
1ha and below	14	7.3	
1.1-2.0	172	89.6	
2.1-3.0	6	3.1	1.52 ha
Total		100.0	
Income Level (₦)			
< 100,000	114	59.4	
100,000 -200,000	30	15.6	
201,000 - 300,000	10	5.2	
301,000 - 400,000	8	4.2	274,724
>400,000	30	15.6	
Total	192	100.0	
Cooperative Society			
No	148	77.1	
Yes	44	22.9	
Total	192	100.0	
Access to Credit			
No	126	65.6	
Yes	66	34.4	
Total	192	100.0	

3.2. Level of climate change awareness by the respondents

Farmer's adjustment to climatic variation is subject to awareness of the threats of occurrence. Table 2 introduced some indices of levels of consciousness of climate change among farmers in Edo State Nigeria. Two (2) (Unpredictable rainfall patterns (2.02) and increased flooding /erosion menace (2.13) out of Six (6) identified indicators of climate change showed an increased level of awareness on

a 3- point rating scale. The result further showed that the remaining four (4) indicators had average values that ranged between 1.79- 1.93 indicating farmers poor awareness. These indicators include rise in temperature (1.79), progressive disappearance of the usual harmattan periods (1.93), shortened duration season (1.80) and increased post-harvest deterioration of crop (1.84).

Table 2. Mean Awareness of Climate Change Occurrence on Farming activities (Field data, 2018).

S/N	Indicators of Climate change (awareness level)	X	SD
1	Unpredictable rainfall patterns	2.0208 **	0.78108
2	Rise in temperature	1.7917 *	0.73866
3	Progressive disappearance of the usual harmattan periods	1.9271 *	0.83659
4	Increase Flooding / Erosion menace	2.1250 **	0.83659
5	Shortened duration of growing season	1.8021 *	0.78967
6	Increased post-harvest deterioration of crops	1.8438 *	0.85012

High Awareness **, Low Awareness *

3.3. Level of Access of Agricultural Insurance welfare

Table 3 showed the percentage distribution of accessibility to agricultural insurance welfare by the respondents. From the result, majority (76.0 %) of them had low level of access of agricultural insurance welfare, followed by 17.7% farmers with moderate level of access of agricultural Insurance welfare. Only about 6 .3% of them had high access to agricultural insurance welfare.

Table 3. Level of Access to Agricultural Insurance welfare (Field data, 2018).

Variables	Frequency	%age (%)
Low Access	146	76.0
Moderate Access	34	17.7
High Access	12	6.3
Total	192	100

3.4. Socioeconomic determinants of access to insurance welfare on climate change adaptation decision

The result of the binary probit model in Table 4 revealed that the coefficients of gender negatively influence access to insurance welfare while educational level, farming experience, farm size, cooperative membership , access to credit , income level and land ownership status positively influence farmers access to insurance welfare at 1% and 5% probability level.

Table 4. Socioeconomic Determinants of Farmer`s Access to Insurance Welfare on Climate change Adaptation decision (Field data, 2018).

Variables	Coefficient (β)	Std. Error	Z-score	Marginal Effects (dy/dx)
Age(Years)	0.0150387	0.0166054	0.91	0.0021791
Gender	-1.15182	0.4600628	-2.50	-0.1668958
education level	1.225467	0.2986428	4.10***	0.1775671
Experience (years)	0.1290455	0.0383848	3.36***	0.0186984
Household Size	0.1375523	0.0925361	1.49	0.019931
Farm size(Ha)	0.2324224	0.099857	2.33**	0.0622166
Cooperative membership	3.100247	0.6246581	4.96***	0.4492182
Access to credit	1.570233	0.3123053	3.13***	0.2275229
Land ownership status	1.024368	0.2361931	4.34***	0.1484284
Income level	0.0000337	0.0000103	3.26***	4.88e-06
Constant	2.762386	1.948298	1.42	

*** and ** = Significant at 1% and 5% probability level respectively. LR Chi (10) = 161.22, Prob>chi^2 = 0.0000, Pseudo R^2 = 0.6596.

3.5. Socioeconomic Determinants of Farmer's Adaptation Decision

The result of the binary probit model in Table 5 revealed that the coefficients of gender, educational level, farming experience, farm size, income and extension contact positively influence

farmer's adaptation decision to insurance welfare at 5% probability level. Gender had negative relationship with farmers adaptation decision at 5% probability level.

Table 5. Socioeconomic Determinants of Farmer's Adaptation Decision (Field data, 2018).

Variables	Coefficient (β)	Std. Error	Z-score	Marginal Effects (dy/dx)
Age(Years)	0.0140083	0.0124877	1.12	0.0035484
Gender	1.753998	0.4302541	4.08***	0.4442993
education level	0.4013362	0.1597793	2.51**	0.1016611
Experience (years)	0.0067707	0.0216234	0.31	0.0017151
Household Size	0.2123918	0.0737397	2.88**	0.0538509
Farm size(Ha)	0.0244824	0.0706713	0.35	0.0062016
Income level	0.0000321	7.60e-06	4.23***	8.14e-06
Extension contact	0.7626136	0.1659998	4.59***	0.1931751
Access to credit	0.6606875	0.281114	2.35**	0.1673566
Cooperative membership	0.9113041	0.3233035	2.82**	0.2308394
Constant	0.5597486	1.430857	0.39	

*** and ** = Significant at 1% and 5% probability level respectively. LR Chi (10) = 138.46, Prob>chi^2 = 0.0000, Pseudo R^2 = 0.5309.

3.6. Adaptation Measures Adopted by the Respondents

The result in Table 6 disclosed that majority of the respondents (49.5 %) were involved in the adaptation measures of multiple cropping system with frequency of 95 respondents, this was followed by 46.9 % of farmers that were involved in mulching, 45.8 % planting of cover cropping. About 42.7 % applied of organic manure, 39.1 % of them adopted planting of early maturing crop varieties. The rest of the farmers applied these adaptation measures; planting of early maturing crop varieties, planting crops that are not susceptible to pest and disease attack, planting of drought tolerant crop varieties, changing crop harvesting dates, planting of trees and the least was irrigation method at 39.1%, 37.0 %, 35.9 %, 33.9 % , 31.3 % and 13.0 % respectively.

Table 6. Adaptations Measures Adopted by Respondents (Field data, 2018).

Variables	Frequency	%age (%)
Irrigation	25	13.0
Multiple Cropping	95	49.5
Planting of trees	60	31.3
Planting of Cover crops	88	45.8
Mulching	90	46.9
Planting of early maturing crop varieties	75	39.1
Changing Crop harvesting dates	65	33.9
Planting drought tolerant crop varieties	69	35.9
Organic manure	82	42.7
Planting pest and disease resistant crops	71	37.0

3.7. Constraints Confronted by Respondents

Majority (50.5 %) of the farmers in Table 7 had poor access to source of information on insurance welfare. This implies that adaptation decision could be hampered due to lack of information. 44.8 % them were faced with lack of access to weather forecast technology while 44.3 % lacked access to credit, 41.1 % had challenge of tedious nature of climate change adaptation activities, 40.6 % were faced with low income level, 37.5 % of them had poor access to land and farm capital, 31.8 % farmers had distance of resident to farm as a constraint 30.2 % of them had constraints on low technical know-how in handling mechanized and technical duties in the farm and 27.6 % of them had constraints of unwillingness to take farming risks to adapt while 18.2 % of them were faced with the challenge of illiteracy.

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Table 7. Constraints Confronted by Respondents (Field data, 2018).

Variables	Frequency	%age
Poor access to source of information	97	50.5
Lack of access to weather forecast technology	86	44.8
Illiteracy	35	18.2
Distance of resident to farm	61	31.8
Low income	78	40.6
Lack of access to credit	85	44.3
Poor access to land and farm capital	72	37.5
Tedious nature of climate change adaptation activities	79	41.1
Low technical Know-how in handling mechanized and technical duties in the farm.	58	30.2
Unwillingness to take farming risks to adapt	53	27.6

3.8. Research hypothesis

The result of the correlation analysis in Table 8 showed that there is significant relationship between climate change adaptation decision and access of insurance welfare by the farmers ($r=0.997$) at 5 % level.

Table 8. Estimation of the contribution of climate change to insurance welfare access (Field data, 2018).

	Climate change adaptation	Insurance welfare access
Climate change adaptation	1 000	0.997
Insurance welfare awareness	0.997	1 000

4. Discussion and Conclusion

4.1. Discussion

The result in Table 1 on the age distribution of the farmers showed that majority (42.7%) of them fell within 31- 40 years age bracket. The average age of the farmer computed was 43years. This is productive and active age. Farmers in this age category could be highly innovative and adoptive. They can take appropriate measures that mitigate the negative impact of climate change. Genders of household revealed that majority (62%) of them were male. This could be attributable to the tedious nature of managing climate change adaptation measures and financial implications involved. This indicated that household heads had to earn off farm income as adaptation strategy. This could supplement dwindling farm incomes that result from drastic changes of the .climate.

The results of marital status showed that majority of farmers were married. Majority (48%) had family size of 1-5 persons with mean family size was 7 persons. This suggests with the large family size as a matter of necessity, had to adopt more coping schemes to contend with the impacts of climate change. The result of educational attainment disclosed that the respondents were educated which could enhance right choice making of appropriate strategy that could aid access to insurance welfare and climate change adaptation decision. By implication it would have been expected to ease access to insurance welfare for climate change adaptation decision among the respondents because of their educational level. Years spent on farming indicate that 53% of them had 1 to 10 years' experience with average farming experience of 14 years. This was a fairly high level experience and respondents could be aware of seasonal variations that are associated with climate change. With this experience, farmers could also be in a good position to choose the most appropriate coping strategy against climate change.

The result of farm size showed that majority of them cultivated farm size between 1.1 to 2.0 hectare(s) of land with average farm size was 1.52 hectares. This could be explained by the fact that they are smallholder farmers. The result of income level showed that majority of farmers had an annual income level of less than ₦100 000 with mean per annum income level of ₦274 724. The result on Cooperative society status showed that 77% of them do not belong to any cooperative society. Belonging

to a cooperative society could have assisted the respondents in accessing credit and useful information to ease adaptation decision. Majority (66%) of them have no access to credit. Access to credit reduces inefficiency as it enables farmers to adopt the better climate change adaptation measures. This infers that the respondents need the insurance welfare scheme for improved production.

The result in Table 2 on awareness of climate change indicators such as rise in temperature, progressive disappearance of the usual Harmattan periods, shortened duration of growing season and increased post-harvest deterioration of crops had a mean rank score of less than 2.0 implying that awareness level was low.

Table 3 showed that majority (76.0%) of them had low level of access of agricultural insurance welfare. Its implication is that the respondents had a high rate of non-accessibility to insurance welfare provision that could affect their adaptation decisions.

The result of the binary probit model showed a pseudo R^2 value of 0.6596) as captured in Table 4. This indicated that the estimated independent variables explain about 66% variation in farmer's access to agricultural insurance welfare on climate change adaptation decision phenomenon. The prob> chi^2 (161.22) showed a positive goodness of fit. The parameter measure of the probit model only provided the order of influence of the explanatory variables on farmer's access to insurance welfare on climate change adaptation decision and did not show the actual degree of change in the coefficients. Thus, the significant effects (dy/dx) from the probit model, which gives an estimate of the predicted change in the rate of access to insurance welfare on climate change adaptation decision with respect to a unit change in an independent variable was also presented in Table 4.

The coefficient of gender was negative and significant at 5% level. This implies that the chances of the farmers in accessing insurance welfare decrease with gender. This suggests that the males more likely to have access to insurance welfare than their female counterparts. This is not surprising because the male has more assets to guarantee credit access from financial institutions.

Educational level (Edu) of the farmers was beneficial and greatly linked to access to insurance welfare to climate change adaptation decision. Educated people as reported by Marr et al. (2016) might be more successful in accessing insurance welfare that aid adaptation decision. The result of the marginal effect on educational level implied that additional units in educational level will yield 0.1775671 increased in probability of having access to insurance welfare on climate change adaptation decision.

Farming experience (Exprien) was positive and is notably connected to farmer's access to insurance welfare on climate change adaptation decision. The result of the marginal impact showed that a unit rise in farming experience will lead to an increase in rate of gaining access to insurance welfare on climate change adaptation decision by 0.0186984. Saqib et al. (2016) reported in their study that farming experience plays an important role in enhancing access to insurance welfare. Farm size (fs) was positive and extremely connected with access to insurance welfare on climate change adjustment decision at 5%. In other words, farmers with more farm sizes are likely to have access to insurance welfare on climate change adaptation decision than farmers with small farm holdings. Kumari et al. (2017) reported similar findings. The outcome of marginal consequences on farm size shows that a one-unit rise in farm holdings would induce a 0.0622166 rise in the rate of access to insurance welfare on climate change adaptation decision.

Co-operative society membership (cosoc) was significantly and positively correlated to the probability of having access to insurance welfare on climate change adaptation decision at 5% probability level. This suggests that those who belong to cooperative society are likely to have access to information on insurance welfare on climate change adaptation decision. Duncan et al. (2017) reported that membership of cooperative society had easier access to insurance than those who did not belong. The outcome of the marginal effects shows that a unit rise in cooperative membership will enhance the rate of access to insurance welfare on climate change adaptation decision by 0.4492182. Access to credit (acred) was beneficial at 1% and positively linked to insurance welfare on climate change adaptation decision, implying that a rise in accessing credit will induce a corresponding rise in insurance welfare utilization on climate change adaptation decision. Cole et al. (2017) opined that through access to credit, farmers can easily offset expenses accruing from hired labour and inputs procurement in adopting certain coping mechanisms to climate change challenges in their farms. The result of the marginal effect showed that a unit increase in access to credit will increase in probability of taking adaptation decision on climate change by 0.2275229. However, access to credit had more effect on access to insurance welfare by the farmers.

Similarly, the result further shows that land ownership status has right positive relation with access to insurance welfare and the variable is statistically significant at 1% level. Hence, land ownership status is an important factor in accessing insurance welfare because it is a symbol of higher social status in the society which also helps in getting credits from financial institutions. The result of the marginal effect shows that a unit increase in land ownership status will increase in probability of accessing insurance welfare by 0.1484284. The coefficient of income level was significant with positive marginal effect in explaining farmers' access to insurance welfare. Result implies that a rise in income level of farmers will give rise to a positive contribution towards farmers' access to insurance welfare to adopt climate change adaptation measures.

The result of the probit model in Table 5 revealed a pseudo R^2 value of 0.5309, indicating that the captured independent variables accounts for about 53% variation in farmer's adaptation decision. The result of prob> chi^2 (0.138.46) specifies that the overall goodness of fit was significant. Gender, household size, educational level, income level, access to credit, extension contact and cooperative membership were parameters that significantly impacted the decision on whether or not to adapt. The coefficient of gender was negative and significant at 1% level. This implies that the males are more likely to adapt to the effect of climate change than their female counterparts. This findings support Mwalukasa et al. (2018) who noted that male-headed households were 18 % more likely to adapt to climate change. This result was contradicted by some studies which also imply that women, compared with men, display a higher degree of both engagement and competence in adapting to climate change (Adams, 2016; Braun et al., 2018).

The coefficient of household size (hhs) was positive and significant at 5% probability level agreed with the decision to adapt climate change. A unit rise in household size of the farmers will have a substantial impact of increasing the proportion of obtaining additional adaptation schemes by 0.0538509. This further shows that larger households have higher demand for insurance welfare to increase agricultural productivity through climate change adaptation decision.

The coefficient of educational level (edu) was positive and significant at 5% probability level agreed with the decision to adapt climate change. A unit rise in educational level of the farmers will have a substantial impact of increasing the proportion of obtaining additional adaptation schemes by 0.1732378. This result was supported by Ndamani and Natanabe (2016) who postulated that educational level of respondents determine their ability to make useful decisions in the face of challenges posed by climate change.

The outcome of the marginal impacts indicated that a unit rise in the income of farmers will cause an increase in the rate of taking positive decision to adapt to climate change by 8.14e-06. Increase in farmer's income increases their adaptive capacity to adjust with dynamism in climatic conditions by adopting various adjustment schemes. This result is congruent with Bahinipati and Venkatachalam (2015) findings that income of farmers is positively related to their livelihood capabilities. The coefficient of extension contact was positive and statistically significant at 1% level. This implies that the more contacts the respondents accessed extension agents, the decision to adopt adaptation measures becomes easier. This is in consonance with Belay et al., (2017) findings that number of extension contacts farmers had with extension agent has direct link with adaptation decision.

Access to credit (acred) was beneficial at 5% and positively linked to climate change adaptation decision, implying that a rise in accessing credit will induce a corresponding rise in climate change adaptation decision. Cole et al. (2017) opined that through access to credit, farmers can adopt certain coping mechanisms to climate change challenges in their farms. The result of the marginal effect showed that a unit increase in access to credit will increase in probability of taking adaptation decision on climate change by 0.1673566. However, income level had more effect on climate change adaptation decision by the farmers.

The coefficient of cooperative society membership was positive and significant. This suggests that farmers who belong to farmers' cooperative have a higher to access insurance welfare to carry out the climate change adaptation measures. The outcome of the marginal impacts indicated that a unit rise in extension contact with farmers will cause an increase in the rate of taking positive decision to adapt to climate change by 0.2308394. However, extension contact had the greater impact on the decision to adopt adaptation measures by the farmers.

The major adaptation measures used by the farmers were multiple cropping system, mulching, planting of cover cropping, application of organic manure and planting of early maturing crop varieties.

It was practice adopted to reduce soil water loss. This supports the findings of Okoroh et al. (2016), which stated that the main climate change effect experienced by farmers were flooding, soil erosion, decrease in soil fertility etc. The results also revealed that the most effective method adopted by farmers in cushioning the effect of climate change were mulching, constant weeding, use of organic manure etc. The major constraints militating against the farmers were poor access to source of information, lack of access to weather forecast technology, lack of access to credit and the least were illiteracy and unwillingness to take farming risks to adapt. This implies that adaptation decision could be hampered due to lack of information.

To ascertain if there was no significant relationship between insurance welfare scheme and climate change adaptation decision among farmers correlation analysis test was conducted. The result of the correlation analysis showed that there is significant relationship between climate change adaptation decision and access of insurance welfare by the farmers (r=0.997) at 5% level. The reason might be postulated by the fact that the resultant effects of climate change is always detrimental which pushed the farmers to seek for insurance welfare scheme that can help to reduce their shocks in the farm.

4.2. Conclusion

The study had showed that farmer's access to insurance welfare is very low and this will drastically affect the decision to utilize adaptation methods that are capital intensive. The restrained access to insurance welfare causes farmers especially the vulnerable to unpredicted revenue distress, particularly from adverse weather condition. They often minimize their earning shock by varying and selecting low-risk activities or technology, which usually have low average proceeds. The provision of insurance welfare will encourage continuity in farming business. Information is the key to power as saying goes. They also lack adaptation information in the study area. Hence the need to insure farms and benefits from insurance agencies become neccessary. It is recommended that Government should make provision for insurance welfare package for farmers for greater productivity. Agricultural production and productivity cannot be maximize without a substantial increased access to extension advice by farmers at all category to assist in dissemination of awareness of agricultural insurance welfare and adaptation measures on climate change and training on climate adaptation in Edo State.

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