



## Factors Affecting Adoption of Indigenous Strategies for Climate Change Adaptation in Imo State, Nigeria (A Survey Using Systematic Sampling of Households in Orlu Local Government Area)

Ahaotu EO<sup>1\*</sup> and Akagha NU<sup>2</sup>

<sup>1</sup>Department of Animal Production Technology, Imo State Polytechnic Umuagwo, Nigeria

<sup>2</sup>Department of Agricultural Technology, Imo State Polytechnic Umuagwo, Nigeria

\*Corresponding Author: Ahaotu EO, Department of Animal Production Technology, Imo State Polytechnic Umuagwo, Nigeria.

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### Abstract

This study aims to find out the indigenous people's experiences on climate change impacts in Imo State, Nigeria and identify their adaptation strategies. It also envisaged establishing the factors affecting adoption of indigenous climate change adaptation strategies in Nigeria. The study will help in proper targeting of adaptation measures among indigenous communities in Nigeria and avoid past trends where by measures have often failed. The study used descriptive statistics to analyze the data collected. The study found out that indigenous people experienced a serious reduction in rainfall amounts and changes in rainfall patterns. There have been increases in temperature, wind strengths and length of dry periods. These have had various negative impacts on their livelihoods. The study established that perception of climate change has a significant positive relationship with adoption of indigenous adaptation strategies. Socio-economic factors of age, local experience, income level, income diversity and land size were found to have positive significant relationships while education and household dependency had a negative significant relationship with adoption. House hold size and gender had no significant relationship. Institutional factors such as information access, market access, credit access, participation and membership to social networks were found to have a positive significant relationship with adoption of indigenous climate change adaptation strategies. Individualization of land tenure was also found to negatively affect adoption. Access to extension service had a significant negative relationship with adoption. This study recommended the need to orient climate change adaptation measures on indigenous people's perceptions and strategies taking cognizance of their underlying factors. Prior assessments before undertaking adaptation actions are thus recommended.

**Keywords:** Indigenous Climate Change; Length of Dry Periods; Household Size and Gender

### Introduction

Global warming is now unequivocal as evident from observed increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea levels. Global temperatures have risen by 10C since 1850 while glaciers and ice sheets are melting across the globe as temperature records are shattered at alarming rates (Kirkland, 2012). Anyona [1] observed that the global average surface temperature will rise within the range of 1.8 to 4°C by the year 2100 while the sea level may rise within the range of 30 to 60°C.

Climate change will lead to increments in the intensity and frequency of droughts, floods and storms (IPPC, 2007). This will in turn constrain economic development [2] and decrease agricultural productivity [3] especially in developing countries due to existent multiple stresses and low adaptive capacity.

Indigenous people are most vulnerable to climate change due to over dependence on climate sensitive natural resources, habitation of fragile ecosystems and marginalization [4]. Indigenous climate change adaptation strategies based on indigenous people's knowledge systems however offer the best option in addressing current and future climate change events [5]. These have enabled

them to adapt to changes in their environments for a very long time [6].

Climate change effects however seldom acts in isolation but interacts with other environmental and social factors [7] that differ between societies (Machira, 2014). The contexts within which indigenous people observe, interact and begin to respond to the impacts of climate change are thus extremely important in determining their perceptions and adaptation [7]. Community perceptions of climate conditions shape the manner in which they anticipate and react to them [5]. The choice of adaptation strategy is also a manifestation of the biophysical, socioeconomic and institutional factors in operation [8].

This study therefore aimed to find out indigenous peoples' experiences and perceptions of climate change and identify their various adaptation strategies. It established the factors that affect adoption of indigenous climate change adaptation strategies.

Climate change will also constrain economic development in developing countries that rely largely on agriculture [9]. It will widen and deepen the divide between the rich and the poor and erode the health and education advances for the very vulnerable [10]. Climate

change will have enormous human rights implications since its impacts translate into abuse of economic and social rights.

Land use and land cover change due to climate change will also force indigenous people into new circumstances and alter their traditional ecosystem management systems (Macchi., *et al.* 2008). In some instances, these impacts will be so high as to completely erase indigenous people’s capacity to adapt, loss of traditional habitats and cultural heritage [11]. Climate change will also affect the behavior of certain natural signals used in indigenous people’s early warning systems such as bird migration hence disorienting their lives (Macchi., *et al.* 2008).

## Materials and Methods

### Research design

The research employed a descriptive research design. The study determined and described the state of affairs appertaining to climate change adaptation in the area. It involved collection of data from the population through interviewing, observation and focus group discussions.

### Target population

#### Study area

The study area is Orlu Local Government Area of Imo - state, Nigeria. The Local Government Area was chosen as the study locations because according to Okonkwo and Ahaotu [12], Orlu Local Government Area is an area with many commercial poultry farms and it is popularly known for egg production and marketing in Imo State, Nigeria. Orlu Local Government Area is one of the twenty-seven Local Government Areas in Imo state, Nigeria. Orlu local government area falls within the western senatorial zone of Imo State alongside Ideato North, Ideato South, Isu, Njaba, Nkwere, Nwangele, Oguta, Ohaji/Egbema, Orsu, Oru East and Oru West local government areas. This place is situated in Orlu geographical coordinates are 5° 47' 0" North, 7° 2' 0" East respectively. The state is mainly agrarian and produces permanent crops and arable crops because of the favourable climatic conditions. The occupations of the rural inhabitants are predominantly farming, cultivating food and cash crops. They also embark on small, medium and large-scale livestock production such as rearing of goat, sheep, pigs, rabbits and poultry as well as marketing of the products. Orlu local government area is found in Imo state, South-east geopolitical zone of Nigeria. The LGA is made up of several towns and villages such as Ogboko, Eziachi, Obinugwu, Obor, Umuna, Umutanze, Umuzike, Umudioka, and Ihioma. The LGA is part of the Orlu senatorial zone and has an estimated population of 393,071 inhabitants with the vast majority of the area’s dwellers being members of the Igbo ethnic group [13]. The Igbo language is commonly spoken in the LGA while the religion of Christianity is extensively practiced in the area. Orlu LGA has an average temperature of 270C with a number of rivers and streams flowing in the area. The LGA witnesses two distinct seasons which are the rainy season which usually occurs between the months of April-October and the dry season which usually falls between the months of November- March.

The climate varies from tropical along the coast to temperate inland and arid towards the North and North East with a bimodal

rainfall pattern. The state has a rich and highly diverse cultural heritage. Climate change in Orlu Local Government Area of Imo State, Nigeria has led to negative impacts on food insecurity, health, water availability, displacement of communities and conflicts over natural resources [14]. These impacts are compounded by environmental degradation and the fact that the country’s economy is largely dependent on climate sensitive sectors.

### Sampling procedure

The sampling procedure for the study was a three-stage multistage sampling. The first stage involved purposive selection of three sub locations each representing one of the three major agro ecological zones and livelihood zones. The second stage involved selecting 10% of the total households in each of these sub locations. Systematic sampling was then be used to select individual respondent’s households within each of the three areas.

### Data collection methods and instruments

Data was collected from both secondary and primary sources. Results from the various methods were then crosschecked, validated and harmonized using the triangulation approach.

Operationalization of variables		
	Parameters	Indicators
i	Adoption of indigenous climate change adaptation strategy	Households level of use of indigenous strategies for various aspects of climate change adaptation
ii	Age	Age of household head
iii	Credit access	Number of time one has accessed credit in the one year
iv	Education level	Level of education reached
v	Extension service access	Number of contacts with extension service in the last one year
vi	Gender	Gender of household head
vii	Household dependency	Proportion of residents >10 or <65 years old
viii	Household size	Number of residents in an household
ix	Income diversity	Number of channels for earning income
x	Income level	Agricultural production in the last one year
xi	Information access	Number of information channels on indigenous knowledge
xii	Land size	Size of land owned
xiii	Land tenure	Type of tenure household holds its land
xiv	Local livelihood experience	Number of years of active participation in pursuing a livelihood in the area
xv	Market access	Number of times one attends the market per month
xvi	Participation level	Number of meetings attended in the last one year
xvii	Perception of climate change	Level of perception of climate is changing
xviii	Membership to social networks	Number of community group to which one is a member

Table 1: Operationalization of Variables.

**Results and Discussions**

The impacts of climate change among indigenous people in Orlu Local Government of Imo State, Nigeria.

According to the views of the participants, climate change was found to manifest itself in various ways. These include; reduction in amounts of rainfall and shortening of the rainy seasons. There was also change in rainfall patterns through early and late onset and also early offsets. The rainfall sometimes was very intense and over a short period of time rather than being normally distributed over a long season to sufficiently supports crop growth.

The temperatures in the area were also perceived to have highly increased. There has been lengthening of the dry seasons and the

sunshine seemed much hotter than before. The participants also noted increase in the strength and speeds of winds. These weather changes were found to have many negative impacts by the participants.

One of these impacts is a great decline in farmlands crop productivity. This has led to frequent occurrences of famines. The productivity of trees and growth rates has also decreased thus leading to reduction in biomass resources example wood. Impacts of climate change on trees and shrubs are also impacting negatively on honey production as bee forage diminishes. This reduced economic potential has aggravated the areas marginalization in development [15,16].

			<b>Adoption of indigenous adaptation strategies</b>	<b>Perception of climate change</b>
Spearman's rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	.735**
		Sig. (2-tailed)	.	.000
		N	105	105
	Perception of climate change	Correlation Coefficient	.735**	1.000
		Sig. (2-tailed)	.000	.
		N	105	105

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

**Table 2:** Correlation Between Perception of Climate Change and Adoption of Indigenous Climate Change Adaptation Strategies.

There has been a decline in available water resources leading to acute scarcity especially during the dry periods. This has been due to the drying up of once permanent streams. These have either entirely dried up or transformed into seasonal intermittent flows. This decline in water resources has led to an increase in the distance to watering points and length of time taken in collecting the commodity.

Occurrences of floods are also on the rise with change in rainfall patterns. Short intense rains especially in the head waters cause the streams and river banks to break leading to massive flooding [17]. This results in heavy crop damage and other economic losses. Sedimentation also due to such occurrences is common leading to filling up of water pans. Streams at times fill up with sediments increasing the likelihood of floods. Short intense rains also increase soil erosion hence deterioration of soil conditions and productivity. Water quality is also reduced through increased turbidity in this manner.

Changes in weather patterns due to climate change are also eroding the effectiveness of traditional forecasting and early warning systems [18]. This is because the changes affect the alignment of weather events with the behavior of traditional indicators such as birds, insects and frogs, the moon and the sun. This negative effect on traditional weather forecasting affected effective decision making and planning especially in regard to agricultural activities.

As climate change impacts increase, more resources are committed to dealing with them rather than on development. More family financial resources and efforts have to be committed to coping with impacts for example, through buying and provision of relief food rather than other development activities such as paying school fees and acquiring assets. More government resources are also committed to relief activities rather than other also imperative development activities such as infrastructural development. Climate change is thus negatively impacting the economic development of indigenous communities in Orlu Local Government Area, Imo State, Nigeria.

**Perception of climate change and adoption of indigenous climate change adaptation strategies**

According to the study 76.2% found climate to have greatly changed while 16.2% said it had changed. Only 7.6% said climate had not changed.

To find out the relationship between climate change and adoption of indigenous climate change adaptation strategies. A Spearman's correlation analysis was calculated thus showing a strong significant correlation of r (0.735 p<0.01) as shown in table 2.

Perception of climate change therefore has a positive effect on adoption of indigenous climate change adaptation strategies. This is because adoption starts with perception of the problems fol-

lowed by response. The perception of a household towards climate change will thus influence their choice of adaptation strategies. These findings were in agreement with [19,20].

**Gender**

The study found 25.7% of the households to be female headed while 74.7% of the households were male headed. A Spearman’s rho correlation analysis was calculated to find out the relationship between gender and adoption of climate change adaptation strategies. A small correlation  $r (0.72) p > 0.05$  that was not significant was found. This is as shown in table 3.

Gender therefore does not affect adoption of indigenous climate change adaptation strategies. This could be due to women just as men having access to information and resources necessary for adoption of indigenous climate change adaptation strategies. Also, despite women being very vulnerable they are responsible for much agricultural hence have great experience.

**Local livelihood experience**

According to the study, 28.6% of the respondents had a local experience of 1 to 25 years, 32.4% an experience of 26 to 40 years, 21.9% an experience of 41 to 55 years while 17.1% had an experience of more than 55 years.

On calculating, a Spearman’s correlation analysis between local experience and adoption of indigenous climate adaptation strategies was used. A positive significant correlation  $r (0.679) p < 0.01$  was found. This is as shown in table 3.

		Gender		Adoption of indigenous adaptation strategies	
Spearman’s rho	Gender	Correlation Coefficient	1.000	.072	
		Sig. (2-tailed)	.	.464	
		N	105	105	
	Adoption of indigenous adaptation strategies	Correlation Coefficient	.072	1.000	
		Sig. (2-tailed)	.464	.	
		N	105	105	

**Table 3:** Correlation between gender and adoption of indigenous climate change adaptation strategies.

		Adoption of indigenous adaptation strategies		Local livelihood experience	
Spearman’s rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	.679**	
		Sig. (2-tailed)	.	.000	
		N	105	105	
	Local experience	Correlation Coefficient	.679**	1.000	
		Sig. (2-tailed)	.000	.	
		N	105	105	

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

**Table 4:** Correlation between local experience and adoption of indigenous climate change adaptation strategies.

This therefore means local experience has an effect on adoption of indigenous climate change adaptation strategies. This is because the more experienced farmers have more knowledge on climate change and indigenous practices. This agrees with [21].

**Age**

The study found 28.6% of the households to be between 1 and 35 years, 33.3% to be 36 to 50 years, 21.9% to be 51 to 65 years while 16.2% were above 65 years old.

On calculating a Spearman’s correlation analysis between age and adoption of indigenous climate adaptation strategies. A positive significant correlation  $r (0.666) p < 0.01$  was found. This is as shown on table on table 5.

		Adoption of indigenous adaptation strategies		Age	
Spearman’s rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	.666**	
		Sig. (2-tailed)	.	.000	
		N	105	105	
	Age	Correlation Coefficient	.666**	1.000	
		Sig. (2-tailed)	.000	.	
		N	105	105	

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

**Table 5:** Correlation between age and adoption of indigenous climate change adaptation strategies.

This therefore means age has an effect on adoption of indigenous climate change adaptation strategies. This is because the older farmers have more knowledge and experience on indigenous methods and better perception of climate change. The younger farmers also tend to be more receptive to modern methods and thus shun the indigenous ones. This is in agreement with Ziervogel and Zermoglio [22].

**Education level**

The study found 23.8% of the household head to have attained no education. More so 33.3% to have attained lower primary school level education, 27.6% to have attained upper primary school level education while 15.2% had attained post primary school level education.

On calculating, a Spearman’s correlation analysis between education and adoption of indigenous climate adaptation strategies was used. A negative significant correlation  $r (-0.544) p < 0.01$  was found. This is as shown on table in table 6.

This therefore means education has a negative effect on adoption of indigenous climate change adaptation strategies. This could be since the modern education system is not tailored on indigenous knowledge and thus tends to erode it, interrupting channels



of its transmission and inculcating values that may crash with it and undermine it. This finding is in agreement with [12].

			Adoption of indigenous adaptation strategies	Education level
Spearman's rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	-.544**
		Sig. (2-tailed)	.	.000
		N	105	105
	Education level	Correlation Coefficient	-.544**	1.000
		Sig. (2-tailed)	.000	.
		N	105	105

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

**Table 6:** Correlation between education and adoption of indigenous climate change adaptation strategies.

**Land size**

Only 81% of the households felt their land was adequate in meeting their needs while 19% felt otherwise. The study found 39% of the households to have 0 to 2 acres of land, 17.1% to have more than 2 to 3 acres, 21% to have more than 3 to 4 acres while 22.9% have more than 4 acres of land.

A positive significant correlation  $r(0.596) p<0.01$  was found. This is as shown in table 7.

			Adoption of indigenous adaptation strategies	Land size
Spearman's rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	.596**
		Sig. (2-tailed)	.	.000
		N	105	105
	Land size	Correlation Coefficient	.596**	1.000
		Sig. (2-tailed)	.000	.
		N	105	105

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

**Table 7:** Correlation between land size and adoption of indigenous climate change adaptation strategies.

This therefore means land size has a positive effect on adoption of indigenous climate change adaptation strategies. This is because those who larger land has more capital and resources to invest in adaptation strategies. This is in agreement with Ford [23].

**Household size**

Up to 13.3% of the households had 1 to 4 members, 36.2% had 5 to 6 members, 34.3% had 7 to 8 members while 16.2% had more than 8 members. This is as shown on table 4.18 On calculating a Spearman's correlation analysis between household size and adoption of indigenous climate adaptation strategies. A no significant correlation  $r(0.051) p<0.01$  was found.

No significant correlation  $r(0.051) p<0.01$  was found as shown in table 8.

			Adoption of indigenous adaptation strategies	Household size
Spearman's rho	Adoption of indigenous adaptation strategies	Correlation Coefficient	1.000	.051
		Sig. (2-tailed)	.	.605
		N	105	105
	Household size	Correlation Coefficient	.051	1.000
		Sig. (2-tailed)	.605	.
		N	105	105

**Table 8:** Correlation between household size and adoption of indigenous climate change adaptation strategies.

This therefore means household size has no effect on adoption of indigenous climate change adaptation strategies. This is because although the larger household has a bigger labor force. They have higher consumption pressures which could hinder their capacity to adopt. They may also be forced to divert part of their labor to nonindigenous activities in a bid to cope with the higher consumption pressures. This agrees with [24].

**Discussion**

According to the study the indigenous people in the area have experienced various changes in the local climate. These include a decrease in the amount of rainfall and changes in rainfall patterns. They have also witnessed an increase in temperature levels and lengthening of the dry seasons. There has been an increase in the speed and strength of winds. These have led to various impacts including reduced agricultural production hence food insecurity, acute water scarcity and increased poverty. There has also been a breakdown in societal morals, increase in crimes and conflicts. Climate change has also brought about a decline in the areas economic potential and diminishing of livelihood options. More so there has been increase in pests and incidences of diseases.

Various indigenous strategies for adapting to climate change identified include diversification of the types of crop and animals grown and kept. There has also been a shift towards fast growing crop varieties and increased keeping of small livestock. Indige-

nous animal and crop breeds which are more resistant to the vagaries of climate change are also mostly adopted. Indigenous soil and water conservation strategies such as water pans and stone buds are widely used. Agroforestry using indigenous trees is also a commonly used adaptation practice. Resilient indigenous strategies for crop and animal husbandry such as mixed cropping, cover crops, animal mobility and cultivation along the river banks during drought are also used as adaptation strategies.

The people also espouse sharing and reciprocity as a means of coping with disasters. Traditional conflicts resolution mechanisms, beliefs, taboos, customary laws and governance systems also come in handy in supporting adaptation to climate change. Other coping mechanisms include indigenous weather forecasting and early warning systems to guide adaption. Indigenous pest control methods and medicine are also widely used.

The study found climate change perception to have a positive significant relationship with adoption of indigenous climate change adaptation strategies. A positive significant relationship was also found to exist between adoption and various socioeconomic factors including: local experience, age, income level, income diversity and land size. Negative significant relationship was found to exist between adoption of indigenous climate change adaptation strategies and the factors of education and household dependency. No significant relationship was found to exist between adoption and the socioeconomic factors of household size and gender.

The study also established a positive significant relationship between adoption of indigenous climate change adaptation strategies and various institutional factors. These include: information access, credit access, market access, participation and membership to social networks. Individualization of land tenure was also found to have a negative effect on adoption of indigenous climate change adaptation strategies since it reduces the capacity to practice them. A negative significant relationship was found to exist between access to extension service and adoption of indigenous climate change adaptation strategies.

## Conclusion

Indigenous people in Orlu Local Government Area of Imo State, Nigeria have experienced changes in their local climatic conditions including reduction in rainfall amounts and changes in patterns. There has been an increase in temperatures and lengthening of dry seasons. More to this there has been increased strength and speed of winds in the area. This has led to various impacts including increased food and water insecurity, increased poverty, reduced economic potential and livelihood options. There has also been an increase in pests and incidences of disease. The impacts also caused an upsurge of crime, immorality and conflicts among indigenous communities. A change in local climate had been witnessed by 92.4% of the respondents.

Various socio-economic factors affect adoption of indigenous climate change adaptation strategies in Orlu Local Government

Area of Imo State, Nigeria. Some of these socio-economic factors have a positive relationship with adoption of indigenous climate change adaptation strategies These include local experience  $r(0.679) p<0.01$ ; age  $r(0.666) p<0.01$ ; income level  $r(0.528) p<0.01$ , income diversity  $r(0.576) p<0.01$  and land size  $r(0.596) p<0.01$ . It also found a negative significant relationship between adoption and education level  $r(-0.544) p<0.01$  and household dependency  $r(-0.534) p<0.01$ . A positive non-significant relationship was found to exist between adoption of indigenous climate change adaptation strategies and house hold size  $r(0.051) p<0.01$  and gender  $r(0.72) p>0.05$ .

According to the study, indigenous people in Orlu Local Government Area of Imo State, Nigeria are experiences changes in their local climatic conditions that are having many negative and specific impacts on their livelihoods. These people also have developed various indigenous adaptation strategies that they are using in coping with the impacts of climate change.

The adoption of these indigenous climate change adaptation strategies however is subject to various underlying socioeconomic and institutional factors that affect it. These include socioeconomic factors like age, local experience, land size, income level and income diversity that have a significant positive relationship thus influence on adoption. There are other socioeconomic factors like household dependency and education that have a negative thus influence on adoption.

More so institutional factors such as market access, information access, credit access, participation and membership to social networks have a significant positive relationship thus influence on adoption of indigenous climate change adaptation strategies. Others such as access to extension service have a significant negative relationship hence influence on adoption. Individualization of land tenure also negatively affects the practice of indigenous agricultural practices.

## Recommendation

- Extension officers should be encouraged to identify effective indigenous climate change adaptation strategies, learn and promote them and also orient and base their trainings on this knowledge.
- Local people who are experienced in indigenous climate change adaptation strategies need to be involved in provision of extension services and other activities geared towards climate resilience.
- Communities should be involved in development activities and decision making through inviting farmers to development meetings in order to get their views on the right courses of action to take.
- Extensive efforts should be geared towards increasing membership to social networks through more community mobilization and registration of more community groups.

- There is need to train the indigenous people on issues related to credit facilities in order to eliminate their distrust towards credits, build their knowledge and increase borrowing.

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