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Socio-Economic Attributes of Residents as Drivers of Adaptation to Climate Change Effects in a Nigerian Traditional Urban Center

Abel Omoniyi Afon[1], Olanrewaju Timothy Dada[1*] and Gbemiga Bolade Faniran[1]

[1]Department of Urban and Regional Planning, Obafemi Awolowo University, Ile- Ife, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author OTD designed the study and wrote the draft of the manuscript. Author AOA supervised the research and prove-read the manuscript. Author GBF designed the framework for research methodology and editorial works. All authors read and approved the final manuscript.

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ABSTRACT

This paper examined residents' socio-economic attributes as drivers of adaptation to climate change effects in Ibadan metropolis, Nigeria. Through systematic random sampling, primary data were obtained from 442 household heads in the core, transition and sub-urban residential areas. The study established that residents' socio-economic characteristics varied along the line of the identified residential areas. The major adaptive strategies adopted were reactive rather than anticipatory. The three most important adaptive strategies measured on a 5-point likert scale were 'repair/replace damaged properties' (3.76), 'eliminate deliberate dumping of waste in drain' (3.72) and 'listening to information about climate change' (3.70). Adaptive strategies in the different residential areas were similar, but different in magnitude as denoted by the resident response index ($\overline{RRI}$) **$\overline{RRI}_c$=3.35, $\overline{RRI}_t$=3.46 and $\overline{RRI}_s$=3.55**. Residents in different socio-economic groups, especially in the education status and income groups exhibited different levels of mean score, but showed that same responses were given to the same climate change effects. The study concluded that residents were susceptible to similar adverse effects of climate change and that the contents of

**Corresponding author: Email: dtolanrewaju@gmail.com;*

environmental education to all residents may have to be the same, though, with varied methodology due to the significant difference in socio-economic attributes.

Keywords: Adaptation; climate change; residents; response; socio-economic attributes.

1. INTRODUCTION

Global climate change is a multi-faceted environmental challenges facing today's societies due to it negative impacts on agriculture, human health, physical environment, roads and buildings [1,2]. These negative impacts are more pronounced in the developing countries such as Nigeria [3-5]. Recent trends revealed that climate change impacts experienced in Nigeria are similar to those experienced around the world [6,7]. These include general warming (day and night temperatures all year round); irregular rainfall timing and quantities; changes in seasons (longer summers); increased climate variability (e.g. floods, droughts, wind storm and heat waves); higher sea- levels; and increasing frequency and intensity of extreme weather events [8,9]. At present, there are overwhelming evidences to conclude that climate change is real, that it will become worse and that the residents of most developing nations will be the most affected [10].

The magnitude of these impacts has attracted the attention of local and international research communities especially on adaptation and mitigation [10]. To date, most efforts at reducing these challenges have centered on top-down approaches and policy solutions. In other words, approaches suggested emanated from the intuition and technical knowledge of engineers, academics and policy makers [11,12]. Residents are hardly considered or respected to air their local response, yet they usually respond practically to these problems. How they respond is therefore worthy of examination. Such responses can then be used as a bottom-up approach to evolve sustainable and environmental friendly approaches.

The bottom-up approaches generate knowledge from the perspective of those being researched, instead of the perspective of the researcher [13]. According to [14], a bottom-up approach deals with social issues through a participatory process that gives hope instead of fear to those who participate. It reveals the capacity, constraints and access to coping mechanisms of those impacted in response to changing climatic conditions. Results from bottom-up approaches are more lasting and acceptable to end-users and allows communities to find agreement on key issues.

Researches have identified the advantages of bottom-up approach in which residents' adaptation to climate change effects connotes [15,16]. These advantages include: added time to study issues and develop the process; enhanced credibility of the decision making process; early identification of the diverse perspectives on the issues of concern; generation of solution options; shows residents' responses to issues as related to their socio-economic capacities and perceived level of problem.

The bottom-up approach responses to climate also differs from the technical approach of the policy makers. Such responses according to [10] are usually location-specific, autonomous in terms of individuals' socio-economic capacities and according to perceived climate change effects (vulnerability). Such local approach is worth examining for a number of reasons:

(i). reveal how one residents' response could increase the vulnerability of others
(ii). serve as a medium of environmental education/enlightenment campaign to residents;
(iii). supplement scarce government monitoring, inspection and enforcement resources;
(iv). create a basis for understanding climate related issues which in turn could create the necessary condition for government offering financial and technical assistance to residents.
(v). information obtained could be used as basis of responding to climate change issues in geographical regions with similar social, economic and environmental backgrounds.

In order to improve the ability of residents to adjust to ongoing and future climate changes, improved understanding of the risks

they face is needed. It is on this basis that this study attempts to examine adaptive strategies adopted by residents and how these strategies vary in the different residential areas of Ibadan metropolis.

1.1 Issues in Responses to Climate Change

Mitigation and adaptation are the two major approaches to addressing climate change. While mitigation involves working to reduce and stabilize the concentration of greenhouse gases in the atmosphere, adaptation is a localized reactive measure that lessens negative impacts and increase resilience of natural and social systems to climate disruption. Adaptation (reactive or anticipatory) which is the focus of this research has been widely recognized to be essential in confronting climate change impacts in two ways. One is in relation to the assessment of impacts and vulnerabilities and the other is to the development and evaluation of response options [17]. According to [18], adaptation is any adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of change or take advantage of new opportunities.

Adaptation is a complex, multidimensional and multi-scale process. From the opinion of [19], it happens in the context of dynamic social, economic, technology, biophysical and political conditions of the system, sector or individual. However, the climate change adaptation process is in terms of type, scale, timing and outcome of the responses, as well as the factors that influence adaptation [20,15]. The adaptation responses can be classified according to the spatial scale at which they occur (such as from top-down, state-led investments in infrastructure); intent (either reactive or proactive); timing with respect to the climate stress; duration (short- or long-term); form/type (technological developments, government policies and behavior change) and effect (enhanced stability or resilience) [1].

Depending on timing, adaptation can be either reactive or anticipatory [21,22]. Reactive adaptation appears after the occurrence of climate change impacts, while anticipatory adaptation takes place before climate change impacts occur. Similarly, it can also be autonomous or planned [23]. Autonomous adaptation is a natural or spontaneous adjustment to a changing climate without any policy plan or decision [23]. Conversely, planned adaptation is adjustment which takes place in accordance with the intervention of the government or any other informed decision-maker. It must be noted that planned adaptation can be both reactive and anticipatory while autonomous adaptation is exclusively reactive.

It can be categorized as well depending on the concerned actors. In this sense, it can be public and private [17,22]. Private adaptation is undertaken by individual households or commercial firms while public adaptation is undertaken by governments. [24] posited that private adaptation is performed for the individual's own benefit whilst public adaptation offers benefits for many. According to [25], autonomous and planned adaptation overlaps with private and public adaptation respectively.

Likewise, adaptation can be categorized depending on duration. Therefore, it can be tactical or strategic [26]. [27] submitted that tactical adaptation comprises the daily or weekly management decisions made in response to an immediate stimulus. On the contrary, strategic adaptation represent more enduring, often anticipatory, actions which are made with a view to the longer term and which alter the nature of the activity in some way [27].

According to [28], residents' adaption to climate change is determined by their economic resources, technology, information and skills, infrastructure, institutions and equity. Others researchers such as [29] identified networks, collective action and social capital as determining factors in adaptation. According to [30], level of education is proportional to one’s ability to receive, decode and understand information relevant to making decisions in the face of climate related disaster. The work of [31] indicated a positive relationship between education level and adaptation to climate change. Evidently, residents with higher levels of education are more likely to adapt better to climate change. However, early studies show a positive correlation between income and adaptation [32,33].

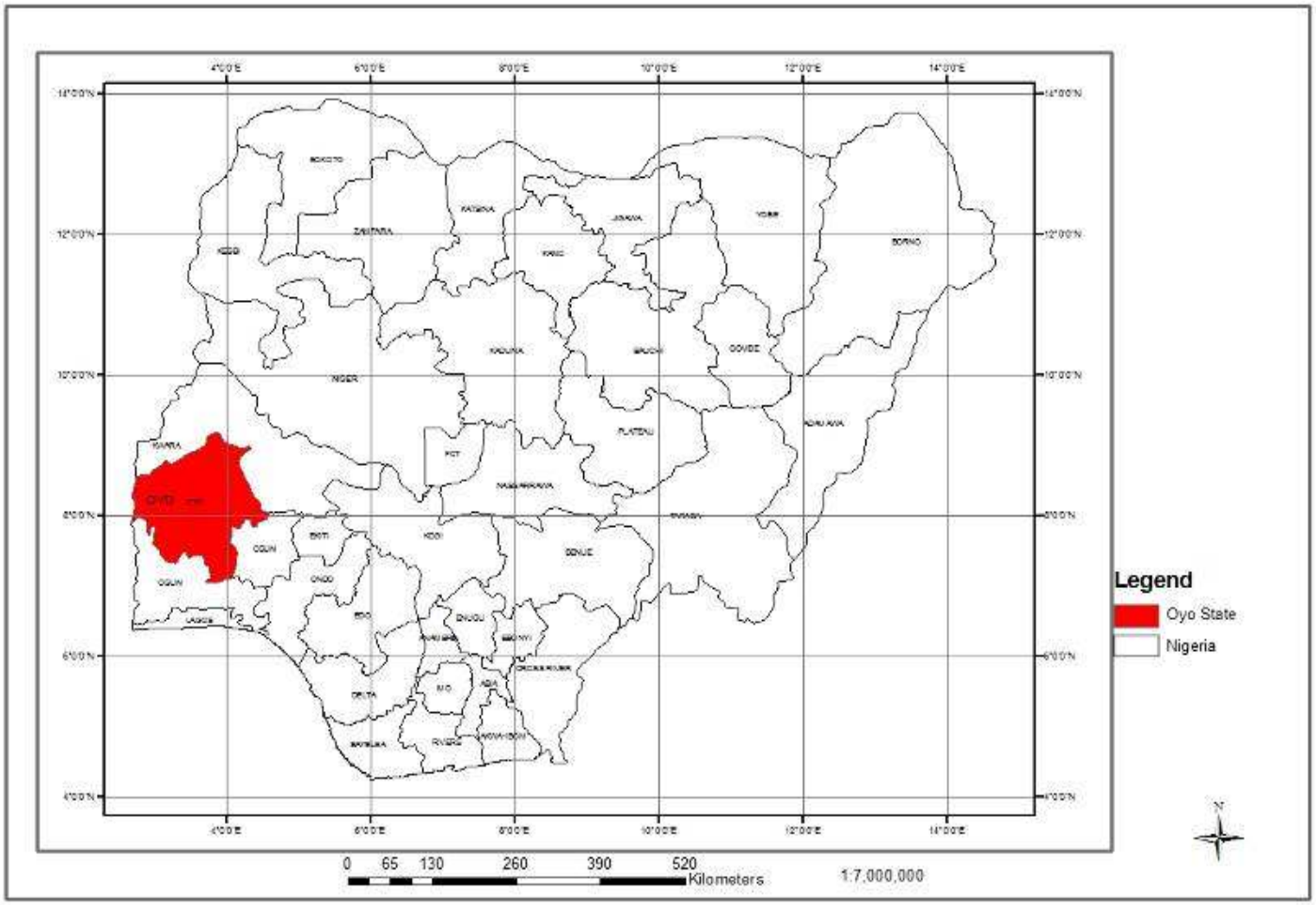

Fig. 1a. Map of Nigeria showing the location of Oyo State.
Source: National Space Research and Development Agency (NASRDA) (2015)

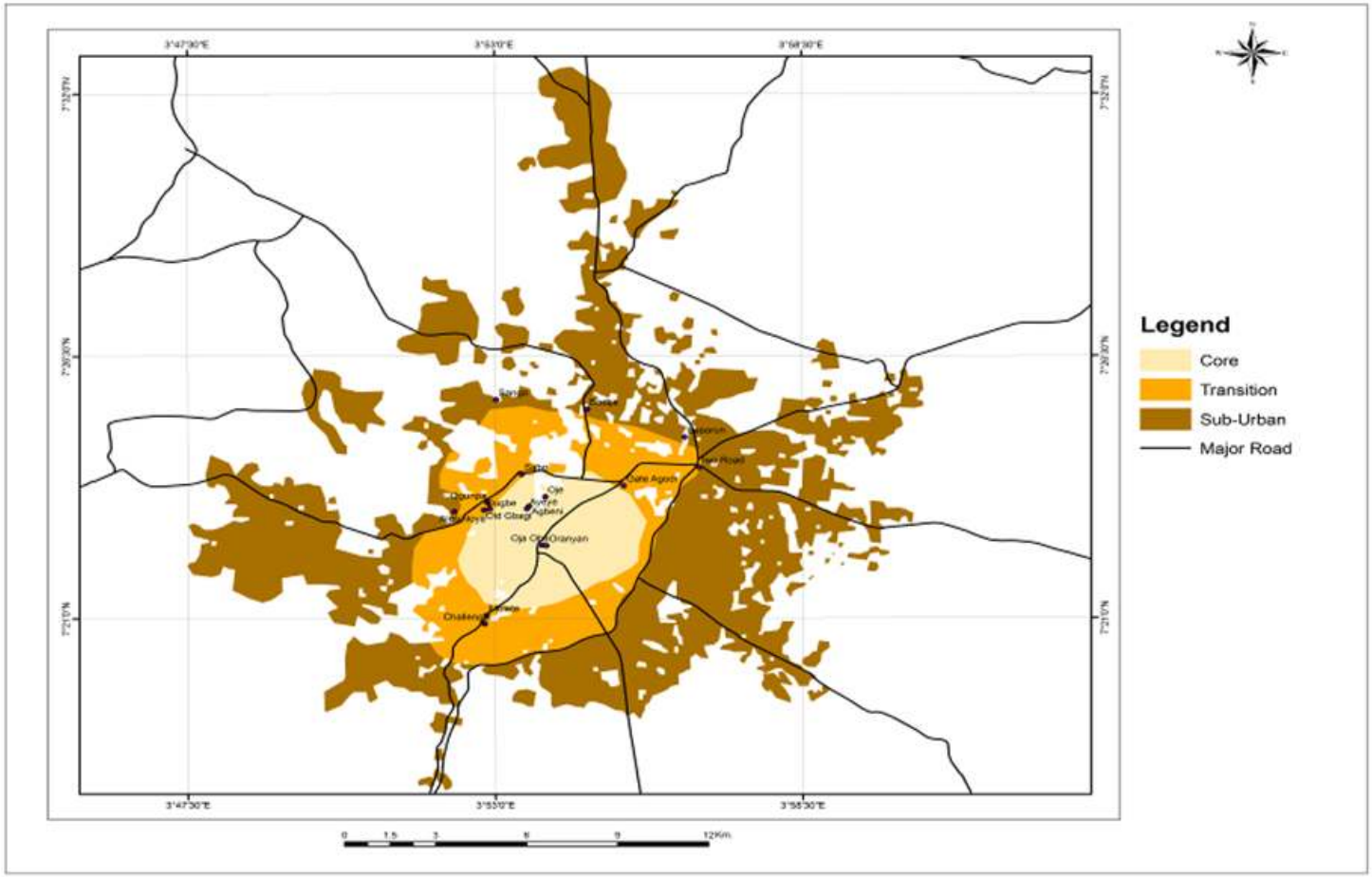

Fig. 1b. Map of Ibadan Metropolis showing the different Residential Areas
Source: National Space Research and Development Agency (NASRDA) (2015)

Similarly, the work of [34] and [35] indicated a positively significant effect of age on adaptation to climate change, others have shown otherwise [36-38]. From the above studies, it was conclusively hypothesized that age of residents would increase the probability of adapting to climate change. Also, the influence of household size on the decision to adapt can be seen from two angles. On one hand, households with many family members may be forced to divert part of their labor force to other activities in an attempt to earn more income to ease the effects of climate change [39]. On the other hand, large household would enable a household to adapt easily to climate change impact because they have fewer labor shortages at these times [40]. Here it is assumed that households with large families would likely adapt to climate change than small sized household.

From the above review, it can be concluded that whether adaptation is reactive or anticipatory, autonomous or planned, tactical or strategic, it is highly influenced by socio-economic characteristics of residents. How these socio-economic attributes have influenced adaptation in the study area (Ibadan Metropolis) is the concern of this paper.

1.2 Study Area: Ibadan Metropolis, Nigeria

Ibadan is predominantly a Yoruba-speaking traditional urban center in Nigeria. It was founded the 1820's [41] and lies between Latitude 7° 02' 49" and 7° 43' 21" N, longitude 3° 31' 58" and 4° 08' 20" E. 'Ibadan is the capital of Oyo state (see Fig. 1a) and is made up of eleven local government areas. Five of these: Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West combined to form the Ibadan Metropolis on which this study is focused (see Fig. 1b). The present day Ibadan can be conceived to have three major residential areas identifiable in each of the five LGA making up the study area.

What is regarded as the core is occupied by the early indigenous settlers. This area is predominantly made up of old structures, whose construction predating the colonial period in Nigeria (that is, pre-1914). The core is characterized by old residential buildings, poorly ventilated, dilapidated, squalid and deficient in infrastructure. Similarly, the transition is characterized by a strong mix of land uses such as commercial, administrative and residential. Unlike the core area, most of the residential buildings enjoy fair accessibility to the major roads.

Finally, the sub-urban is characterized by modem and structurally sound buildings, built on approved private residential layouts [42,43].

Ibadan, like any other tropical city is with distinct wet and dry seasons. The climate is tropical and has mean minimum annual temperature of 21℃ (68.80F) but in consonance with seasonal variations in radiation, sunshine and cloud cover, the mean annual temperature, could change. Between March and October, the prevalent winds in the city is the moist maritime South-west monsoon which blows inland from the Atlantic Ocean, this is the period of rainy season. November to February is the period of dry season when the dry dust laden winds blow from the Sahara desert. The mean annual rainfall of about 1,205 mm, falling in approximately 109 days with two rainfall peaks in June and September.

Ibadan had experienced what can be regarded as climate change primarily in two ways. The first is through frequency of flooding and/or drainage congestion, while the second is changes in seasonal pattern, that is, precipitation pattern. The first flood recorded in Ibadan was in 1948, while the second was in 1963. However, between 1963 and 2015, there had being eight serious flood disasters. These were recorded in 1978, 1980, 1985, 1987, 1990, 2011, 2012 and 2014.

2. METHODOLOGY

2.1 Data Collection

The study utilised mostly primary data obtained through questionnaire administration on household heads in three identifiable residential areas. Multi-stage sampling technique was employed to select household heads on which questionnaire was administered in the different residential areas. The first stage was the stratification of the five Local Government Area (LGA) into the three identifiable residential areas: The core, transition and sub-urban. In the second stage, each LGA's was stratified into the existing political wards delineated by Independent National Electoral Commission (INEC) for the election purposes. In the third stage, a political wards was purposively selected in each residential zone for study. Buildings where

household heads were selected was chosen using systematic random sampling.

The first building where household was selected for survey was randomly chosen and the subsequent unit of investigation was every hundredth buildings (1%). A total of 348 buildings were selected from where a household head was sampled per floor. Information obtained from the valuation office in Ibadan metropolis indicated that there were 14257, 10968 and 9646 buildings in the core, transition and suburban residential areas respectively. The sampling procedure, resulted into administering 442 questionnaire. Data obtained from residents, include the socio- economic characteristics, adaptation strategies adopted among others.

2.2 Data Analysis

Residents' response to climate change was measured in this study through a personally devised index termed *Resident Response Index* (RRI). Residents rated the identified responses which were obtained through literature review using one of the five Likert scales of *Very Important* (VI), *Important* (I), *Just Important* (JI), Not *Important* (NI) and *Not at all Important* (NA).

To arrive at RRI, the following steps were followed:

(i). A weight value of 5, 4, 3, 2 and 1 were attached respectively to each rating of VI, I, JI, NI and NA.
(ii). Summation of weight value (SWV) was calculated. This is the addition of the product of the value attached to a rating and respective number of residents to the rating.
(iii). SWV was divided by the number of residents

This SWV is expressed mathematically as

$$SWV = \sum_{i=1}^{5} X_i Y_i \quad \text{(i)}$$

Where:

SWV = summation of weight value,
X_i = number of residents to rating i;
Y_i = the weight assigned a value (i = 1, 2, 3, 4, 5).

The ***SWV*** divided by the number of residents' gives the ***RRI***.

Thus:

$$\boldsymbol{RRI} = \frac{SWV}{\sum_{i=1}^{5} i = X_i} \quad \text{(ii)}$$

The average level of importance attached to adaptive strategies in the study area was arrived at by the ratio of the sum of the indices to all strategies and total number of strategies rated. Thus

$$\overline{\boldsymbol{RRI}} = \frac{\sum \mathrm{RRI}_{i\text{-}j}}{n} \quad \text{(iii)}$$

Where $\overline{\mathbf{RRI}}$= average index for the study area
n= number of the identified adaptive strategies
The average RRI in each residential zone is denoted as:

$\overline{\mathbf{RRI}}_c$= average index for the core residential area
$\overline{\mathbf{RRI}}_t$= average index for the transition residential area
$\overline{\mathbf{RRI}}_s$= average index for the sub-urban residential area
$\overline{\mathbf{RRI}}_{ag}$= average index for age group
$\overline{\mathbf{RRI}}_{ig}$= average index for income group
$\overline{\mathbf{RRI}}_{es}$= average index for educational status
$\overline{\mathbf{RRI}}_{hz}$= average index for household size

For ease of analysis of the residents' age, the [44] classification was adopted. Residents between the ages of 19 and 30 years were classified as youths, 31-55 years as young adult and above 56 years as adult. To analyse income of residents, the salary grades levels of Oyo State Civil Service wages were utilised. Residents' income between grade levels of 01 to 06 were grouped as low income earners (LI), those on grade level 07 to 10 as middle income earners (MI). Residents whose monthly income was above grade levels 11 were regarded as high income earners (HI). The analysis of household size followed the [45] classifications. Thus, household with 6 members and below, household that contains 7 to 10 members and household with more than 10 members were respectively regarded as the small, medium and large sized.

3. RESEARCH FINDINGS

The research findings are discussed under the various heading below. Unless otherwise stated, the tables are the products of the survey carried out by the authors in year 2014.

3.1 Residents Socio-economic Characteristics

Four important socio-economic attributes of residents were considered in this study. These were residents' age, income, level of education and household size. These socio-economic characteristic were considered important because the works of [46] and [34] argue that response to environmental issues can be explained on the basis of the socio-economic attributes of the study population. The findings on these socio-economic attributes are presented on the basis of the three identified residential areas. The findings are as presented in Table 1.

The average age of residents in Ibadan metropolis was 42 years. This was 41, 44 and 42 years respectively in the core, transition and sub-urban residential areas. However, the proportion of Young adults was 79.9%, 75.1% and 75.3% respectively in the core, transition and sub-urban residential areas. The result of the Analysis of Variance (F=4.862 and p=0.008) confirmed that variation in the age of residents was significant.

Analysis performed on income as another important socio-economic variable showed that the average monthly income of residents in Ibadan metropolis was ₦35, 805.41k (US$ 1 = ₦220 (Central Bank of Nigeria 2015)). The spatial variation showed that the average income in the core, transition and sub-urban residential areas were ₦23, 369.93k, ₦33, 806.20k and ₦53, 728.45k respectively. It was further showed that 38.9% of the residents earned above the mean monthly income of the study area. It was however established that 46.2%, 41.1% and 40.5% of the residents in the core, transition and sub-urban respectively earned above the mean monthly income of the core, transition and sub-urban residential areas. This indicated that the financial capability of residents to respond to climate change will vary. It is conclusive that income was on the increase as distance increases from the core to the sub-urban residential areas of Ibadan metropolis (*F=50.3* and *p=0.000*).

It was evident that 24.4% of residents in Ibadan metropolis had no formal education. The proportion of residents in this category was on

Table 1. Socio-economics characteristics of residents in Ibadan metropolis

	Core	Transition	Sub-urban	Ibadan metropolis
	%	%	%	%
Age group				
19 - 30 (Youth)	13.2	7.6	12.3	11.1
31 – 55 (Young adult)	79.9	75.1	75.3	76.9
56 - 65 (Adult)	5.0	15.2	10.2	10.0
No response	1.9	2.1	2.2	2.0
Income group				
Less than ₦ 22, 000 (Low income)	54.7	36.6	7.9	34.2
₦22, 001-50,000 (Middle income)	27.7	42.1	58.7	41.8
Above ₦ 50, 000 (High income)	3.1	10.3	22.5	11.8
No response	14.5	11.0	10.9	12.2
Education status				
No formal education	30.2	28.3	13.7	24.4
Primary education	13.8	7.6	1.5	7.9
Secondary education	18.9	20.0	15.2	18.1
Tertiary Education	34.6	43.4	69.6	48.4
No response	2.5	0.7	-	1.2
Household size income group				
Small (<=6)	33.3	56.5	83.3	56.6
Medium (7-10)	45.9	39.3	10.9	32.8
Large (>10)	18.9	0.7	-	7.0
No response	1.9	3.5	5.8	3.6
Total	**n=159 (100.0)**	**n=145 (100.0)**	**n=138 (100.0)**	**442 (100.0)**

the decrease as distance increases from the core towards the sub-urban residential zone. This was because 30.2%, 28.3% and 13.7% of the residents respectively in the core, transition and sub-urban area had no formal education. It can therefore be inferred that residents in the core could have low access to information that could increase the chance of adapting to climate change.

The average household size for the study area was 6, while it was 8, 6 and 5 in the core, transition and sub-urban residential areas respectively. It is evident that the mean household size in the core residential area was higher that of Ibadan metropolis. The result of the Analysis of Variance (F=90.488 and p=0.000) confirmed that the variation in household size in the study area was significant.

Analyses of the socio-economic characteristics of residents indicated that these varied along the line of the residential areas. This variation will definitely influence adaptive strategies adopted by residents in response to climate change.

3.2 Intra-Urban Variation in adaptation to Climate Change Effects

To assess residents' adaptation to climate change, it is important to first document residents' opinion on the effect of climate change on them in the different residential areas. It was established that 53.7% of the residents in Ibadan metropolis held the belief that climate change had negatively affected them. The level of awareness of this was on the increase from the core towards the sub-urban residential area. This was because 39.7%, 54.2% and 68.8% of residents in the core, transition and sub-urban residential areas respectively held this claim. The result of Chi-square test (χ^2= 28.879 and p < 0.50) upheld that significant difference existed on this. It was therefore established that there was a direct variation between residents' income, educational status and degree of climate change effects and awareness.

Investigation confirmed that residents adopted a combination of adaptive strategies to climate change effects. The study established that residents in different residential areas relied more on reactive than anticipatory adaptation. The different strategies adopted are presented in Table 2. The average residents' response index ($\overline{RRI}$) for the study area was 3.45, while the $\overline{RRI}$ of the core, transition and sub-urban residential areas were 3.35, 3.46 and 3.55 respectively (that is $\overline{RRI}_c$=*3.35;* $\overline{RRI}_t$=*3.46* and $\overline{RRI}_s$=*3.55*). This pattern suggested that the intensity of responses to major environmental problems resulting from climate change was on the increase along the residential areas. A situation that had something to do with changes in socio-economic attributes of residents most especially income and educational status.

It can be deduced from Table 2 that thirteen of the adaptive strategies were important in the core residential areas. This was because each RRI of the thirteen strategies was higher than the mean index for the area ($\overline{RRI}_c$=3.35). The most important adaptive strategies adopted in the core was 'to repair/replace damaged property' with a mean index of 3.80. Next in order of importance were the 'construction of drainage channels around houses' (3.77), 'the use of prayers/charms/incantation' (3.66), 'eliminating the deliberate dumping of waste into drains' (3.65), 'listening to information about climate change' (3.63), 'children staying at home until flood water subsides' (3.63) and 'building of high walls to prevent flood' (3.51). From adaptive strategies mentioned above, it can be established that the most prevailing problem related to climate change effect in the core was the flood occurrence.

In the transition residential area, the most prevailing climate change induced disaster plaguing the residents was also the flood occurrence. Some of the important adaptive strategies employed were 'the use of prayers/charms/incantation', 'children stay home until flood water subsides', 'eliminating deliberate dumping of waste into drains', 'listening to information about climate change' and 'sensitizing other fellow residents' about causes of climate change'. The RRI respectively were 3.85, 3.82, 3.79, 3.76 and 3.72 (each of which is higher than the zone's index ($\overline{RRI}_t$= 3.46).

With an index of 3.82 respectively, 'repair/replace damaged property' and 'planting of trees for shading from sun heat and breaking wind speed' were the most important adaptive strategies in the sub-urban residential area. These strategies were adopted because the area was generally populated by the wealthy and educated. Other adaptive strategies adopted included 'to keep property above flood level' (3.75), 'avoid indiscriminate bush burning' (3.74) and 'sensitizing other about causes of climate change' and 'the elimination of deliberate dumping of waste into drains' each with an index

of 3.73. The indices of each adaptive strategy mentioned were higher than the index for the zone ($\overline{RRI}_s$= 3.55). The adaptive strategy employed by residents in this part of the metropolis were also found to be those that can reduce the effect of flood. In essence, flood occurrence is also major climate change challenge.

Table 2. Intra-urban responses to climate change in Ibadan metropolis

	Adaptive strategies	Core	Transition	Sub-urban	Ibadan metropolis
		RRI	RRI	RRI	RRI
1	Repair/Replace damaged property	3.80	3.67	3.82	3.76
2	Eliminate the deliberate dumping of waste into drains	3.65	3.79	3.73	3.72
3	Listening to information about climate change	3.63	3.76	3.70	3.70
4	Children staying at home until flood subsides	3.63	3.82	3.56	3.67
5	Use of Prayers/charms/incantation	3.66	3.85	3.41	3.64
6	Construction of Drainage channels are around houses	3.77	3.65	3.48	3.63
7	Sensitizing fellow residents' about causes of climate change	3.33	3.72	3.73	3.59
8	Building high walls to prevent flood	3.51	3.58	3.64	3.58
9	Plant trees for shading from sun heat and breaking wind speed	3.33	3.55	3.82	3.57
10	Avoid indiscriminate bush burning	3.40	3.57	3.74	3.57
11	Improving drainage facilities	3.43	3.64	3.61	3.56
12	Community members cleared blocked drainage channels and water ways	3.42	3.48	3.53	3.48
13	Enforcement of building guidelines	3.42	3.44	3.41	3.42
14	Complied with setback during property development	3.25	3.46	3.53	3.41
15	Borrow money from credit society to effect repairs	3.26	3.51	3.47	3.41
16	keep property above flood level	3.23	3.18	3.75	3.39
17	Construction of more drainages system by government and community	3.20	3.45	3.51	3.39
18	Use of local herbs and drug to treat climate related disease	3.40	3.36	3.41	3.39
19	Devising flood early warning systems	3.19	3.44	3.50	3.38
20	Use of windbreaks/shelter belts	3.14	3.54	3.47	3.38
21	Remove or demolish all structures obstructing drainage	3.21	3.32	3.58	3.37
22	Restriction of land reclamation activities in newly developed areas by government	3.30	3.25	3.55	3.37
23	Relocate property outside community	3.35	3.33	3.43	3.37
24	Emplacement Of Storm Surge Barriers by government and community	3.09	3.38	3.46	3.31
25	Migration from climate risk areas or Move to neighbour's/relatives house	3.14	3.31	3.43	3.29
26	Livelihood diversification (from farming to non-farming)	3.17	3.25	3.36	3.26
27	Provide efficient mechanisms for disaster management	3.28	3.01	3.47	3.25
28	Adjustment in agriculture and forest management	2.97	3.21	3.40	3.19
29	Adoption of a living or green roofs in building	2.96	2.73	3.41	3.03
	Mean (Resident Response Index)	**$\overline{RRI}_c$=3.35**	**$\overline{RRI}_t$=3.46**	**$\overline{RRI}_s$=3.55**	**$\overline{RRI}$=3.45**

Table 3. Relationship between ten most important adaptive strategies and residents' socio-economic characteristics

Adaptive strategies	Age group			Income group			Educational status				Household size		
	Youth	Young adult	Adult	Low	Medium	High	No formal	Primary	Secondary	Tertiary	Small	Medium	Large
Repair and/or Replace damaged property	2.52	2.37	2.66	2.41	2.40	2.42	2.33	2.46	2.43	2.63	2.42	2.44	2.36
Eliminate the deliberate dumping of waste into drains	3.72	3.75	3.66	3.61	3.79	3.83	3.71	3.66	3.75	3.80	3.76	3.62	4.00
Listening to information about climate change	3.17	3.05	3.00	2.93	3.13	3.02	2.98	3.10	3.07	3.09	3.00	3.11	3.26
Children staying at home until flood subsides	3.33	3.24	3.35	3.26	3.23	3.33	3.30	3.24	3.21	3.55	3.24	3.27	3.41
Use of Prayers/charms/incantation	3.46	3.40	3.50	3.40	3.40	3.52	3.44	3.39	3.43	3.37	3.43	3.37	3.55
Construction of Drainage channels are around houses	3.48	3.43	3.52	3.28	3.61	3.46	3.40	3.41	3.49	3.49	3.51	3.35	3.45
Sensitizing fellow residents' about causes of climate change	3.04	2.94	3.02	3.00	2.93	2.98	2.91	2.94	2.96	3.09	2.92	2.94	3.19
Building high walls to prevent flood	3.10	3.14	3.14	3.13	3.09	3.26	3.08	3.11	3.17	3.26	3.16	3.08	3.07
Plant trees for shading from sun heat and breaking wind speed	3.31	3.18	3.33	3.10	3.24	3.40	3.15	3.17	3.25	3.24	3.22	~~3.15~~	3.29
Avoid indiscriminate bush burning	3.60	3.55	3.34	3.52	3.59	3.54	3.56	3.63	3.49	3.65	3.47	3.63	3.70
Mean (*RRI*)	**3.27**	**3.21**	**3.25**	**3.16**	**3.24**	**3.28**	**3.19**	**3.21**	**3.23**	**3.32**	**3.21**	**3.20**	**3.33**
		$\overline{RRI}_{ag}$=3.24			**$\overline{RRI}_{ig}$= 3.23**				**$\overline{RRI}_{es}$= 3.24**			**$\overline{RRI}_{hz}$= 3.25**	

Residents' responses in the three residential zone were majorly to prevent and reduce the effects of flood occurrence. Response strategies in the three identified residential areas were similar but different in magnitude as denoted by the RRI of the same strategy in the different residential areas. The result of the One Way Analysis of Variance suggested no significant difference in response strategies adopted in the three identified residential areas (F=0.408 and p=0.666). The responses were also observed to have technical, environmental education and socio-cultural attributes. The technical aspects involved strategies with serial number 1, 6, 8, 9 and 11; the environmental education aspect include strategy 3 and 7, while the socio-cultural aspect involves strategies 2, 4, 5, 10 and 12 (see Table 2).

3.3 Adaptive Strategies and Residents' Socio-economic Characteristics: The Link

The influence of residents' socio-economic characteristics on ten most important adaptive strategies was examined. The result is as presented in Table 3. It was found that the average indices of the adaptive strategies employed by the youth, young adult and adult were respectively 3.27, 3.21 and 3.25. However, while the youth attached importance to adaptive strategies with serial number 2, 4, 5 and 6. This was unlike the adults that attached more importance to adaptive strategies with serial number 2, 4, 5, 6, 9 and 10 (see Table 3).

It can also be submitted through Table 3 that the magnitude of the adaptive strategies directly varied with increase in income. This is because the indices for low, medium and high income group were 3.16, 3.24 and 3.28 while adaptive strategies with higher indices than the average index in the three income group were 'elimination of the deliberate dumping of waste into drain', 'use of prayers/charms/incantation' 'construction of drainage channels around houses' and 'avoid indiscriminate bush burning respectively.

The pattern of the educational status in relation to the adaptive strategies followed that of the income. The indices of 3.19, 3.21, 3.23 and 3.32 respectively recorded for residents with no formal education, primary school, secondary school and tertiary educational levels confirmed this. With indices of 3.71, 3.30, 3.44, 3.40 and 3.52, which are higher than the average index of responses of residents without formal education (RRI=3.19), it followed that this group attached more importance 'to elimination of the deliberate dumping of waste into drain', 'children staying at home until flood subsidies', 'use of prayers/charms/incantation', 'construction of drainage channels around houses' and 'avoid indiscriminate bush burning' than other responses with above indices respectively.

It was found that the average indices of the adaptive strategies employed by the small, medium and large sized household were respectively 3.21, 3.20 and 3.33. Large household attached importance to 'elimination of the deliberate dumping of waste into drain' (4.00), 'children staying at home until flood subsidies' (3.41), 'use of prayers/ charms/incantation' (3.55), 'construction of drainage channels around houses' (3.45) and 'avoid indiscriminate bush burning' (3.70). This was unlike the small household that attached importance to adaptive strategies with serial number 2, 4, 5, 6, 9 and 10 in Table 3.

The link established between the different adaptive strategies and residents' socio-economic characteristics makes it is obvious that socio-economics attributes are major drivers of adaptation to climate change effects in Ibadan metropolis.

4. CONCLUSION AND RECOMMENDATIONS

The study established that the adaptive strategies adopted by residents in different residential areas were reactive rather than anticipatory. These strategies were short-term and only addresses immediate problems rather than adjustment to evolve anticipatory action. That different educational and income groups exhibited different levels of mean score on the same adaptive strategies showed the same responses to the same climate change effects in the study area. This is an indication that, although, socio-economic attributes varied, the perception of the problems were similar, hence the same adaptive strategies were employed.

In order to evolve anticipatory adaptation which is considered better than reactive, it is recommended that environmental education and awareness programme that would be embarked upon in the three residential zones be similar. For effectiveness, it is essential to have information centre where timely and important data on meteorology will be available for

residents on impending climate change effect. Periodicals such as daily newspaper and weekly magazines can also be used to disseminate information. It is highly recommended that print media using local language be utilised. Similarly, the use of radio jingles, billboards, banners and posters prepared in local languages is highly encouraged.

Environmental education and enlightenment programme can also be embarked upon through speeches to audiences where every socio-economic status will be present. Such congregation may include as we have in churches and mosques. Such speeches can be made during services on Sunday and Juma'at period on Friday. Another means through which these can be done are through talks, speeches, symposia can be organised at the vocational centres, primary, secondary and tertiary schools. This is a means of teaching residents early to be anticipatory in response to climate change effects.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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