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Making Ibadan City Resilient Through Nature-Based Solutions (NBS) & Innovation Integration: The Perspective of Climate Experts

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Abstract: This study examined the perceptions of relevant Authorities on climate change causes and effects on the environment and the city of Ibadan in particular to provide suggestions to the general public and the government about NBS, adaptation plans and mitigation strategies to make Ibadan city resilient. Semi-structured interviews were conducted with Oyo State Ministry of Environment in collaboration with National Council of Climate Change, Ministry of Lands, Housing & Urban Development (MLHUD), and Oyo State New Town & City Development Authority (OYNTCDA) who are experts on issues of climate change and it's effects on the environment in general and cities in particular. 50 interviews were conducted with these professionals and the variables of the questionnaire include: Demographic characteristics of the respondents and their perceptions on human-induced causes of climate change, perceived impact, mitigation strategies and problem associated with nature-based solutions & innovation integration in Ibadan city. descriptive statistics were used for the demographic variables while inferential statistic were used for the other part. Result shows that there was a significant association with the perceptions of the professional regarding the listed options with probability value 0.000. However, there are problems of Nbs and innovation adoption and these problems were rated in order of importance. The study recommends that the general public should be educated on the importance of Nbs and integration of innovation in order to enhance resilience in the city. Also, the use of fossil fuel should be replaced with renewable energies in the home and cities among others.

Keywords: *Resilience, Nature-Based Solutions, Innovation Integration, Perspective of Experts, Ibadan City.*

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I. INTRODUCTION

➢ *Statement of the Problem*

Global warming and the consequent climate change is a global growing problem and has major effect on the environment of the world, cities and spatial planning process (Joanna et al 2020). Climate change creates high-risk events such as flooding, sea level rising and temperature increase among others (Eghuizen 2020). There is social and scientific debate concerning the origin of climate changes that are presently being observed worldwide today (Stolpe Medhaug & Knutti 2017). However, the results of many scientific studies show that human activities have contributed to the increase in Carbon dioxide (Co2) in the atmosphere (World Meteorological Organization (WMO) 2013, Ayoade (2012), Anderson (2017) and IPCC (2021). This increase causes increase in the frequency of Extreme Weather Events (WHO 2021, Nimet 2015 & IPCC 2021). Extreme weather results in water level increase with the shrinking of the sea covered by ice (Jakobson Vilma Jakobson 2016, Chamber 2017). Also, there are increasing number of cases of rising flood in the coastal area due to sea level rising (Wodowinskinskis, Bray, Kitman and Wu 2016). Every additional 0.50 of global warming causes clearly discernible increase in the intensity and frequency of extreme heat waves, heavy precipitation and agriculture and ecological drought in some regions (IPCC 2021).

Floods are the world greatest disaster as asserted by West 2010, Oduola and Akintola 2015. Floods particularly in Western Germany and Bulgium serve as a major case study of a catastrophic natural disaster in advanced developed nations (Fekete et al 2021). The flood casualties include 190 deaths over 240 across Europe with the Ahv valley suffering the worst loss of 134 lives. Economic loss was estimated at 33 billion in Germany, thousands of building were destroyed.

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Study by Calvo-Sancho et al (2026) on human-induced climate change amplification on storm dynamics in Valencia's 2024 catastrophic flash flood experienced rainfall accumulation in a few hours surpassing annual averages (771.8m in 16h in the official weather station at Turis). The flood event led to 230 deaths in span on set October 29th 2024 thousands of homes and infrastructure with economic losses estimate at €29 billion ($34 billion).

In Nigeria, flood disaster occurrence include study by Umar et al 2025 in Maiduguri, Nigeria driven by Alau Dam Cowajide and extreme rainfall caused over 157,000 displacement and 77 deaths and destroyed over 10,000 houses.

Another study by UNOCHA 2025 report details of Bornu, Adamawa and Yobe (BAY) flood disaster resulting in over 238 deaths, displaced 135,000 people and destruction of 60,000 hectares of farmlands.

Accounting for the havoc that Ibadan flooding occurrences have caused over a long period of time, John 2012 reported 1,000 people were rendered homeless in the 1960 flood disaster. The historic flood disaster in Ibadan in 1980 was estimated to have caused damage worth of ₦300 million while number of lives lost was put at 500 people (Akintola 1994), and between 1995-1998 over 12 million naira was estimated to have lost to flood in Ibadan. In 1998 Ogunpa stream swelled and burst it's banks flooding large section of the city an caused more than 100 deaths and destruction of hundreds of homes and valuable properties (Eguaroije et al 2015). He identified some vulnerable areas and said 91% of houses in Ibadan metropolis are vulnerable to flooding with 25% classified as highly vulnerable. This vulnerability results in frequent, severe damage to structures and infrastructure within the city. Ibadan is highly susceptible to flooding with significant events occurring due to over flowing of streams like Ogunpa, Ona and Ogbere, Orogun, Agbowo and Apete high risk areas. (Olukotun 2024)

The global ambition to solve this problem is shown in SDG11 (Sustainable cities and communities) SDG5 (Clean water and sanitation) SDG7 (Affordable and clean energy) SDG9 (Industry, innovation and infrastructure) SDG12 (responsible consumption & production) and SDG13 (climate action). Global commitment to climate change mitigation is evident in the SDGs. Also, cities, national government, the private sector and intergovernmental organizations worked out how to mitigate climate change through net zero Co2 emission (Castro & Kuntz 2022). However, progress toward these goals to date has been limited (Castro & Kuntz 2022). Global temperature are rising especially in the tropics as the incidence of extreme cold days and coastal land is disappearing into the sea at rapid rates (IPCC 2018). Hagenhicher et al suggests ways to build climate resilient, lesson from the 2021 floods in Western Europe. Sun et al assessed urban resilience in the Beijing-Tanging-Hebbel Urban area among others.

Efforts by the government in Oyo State to solve the problem of urban area include Ibadan urban flood management projects (IUFMP) a world bank-supported initiatives through which Eleyele Dam was rehabilitated and 18 priority sites to increase flood resilience. Another effort in smart city initiatives, which focus on people centre smart cities strategies (OYNTCDA smart city blue print 2025) focusing on technology driven inclusive urban development including the Ibadan Circular road corridor and Ilu tuntun, among others.

Unfortunately, cities generate over 70% greenhouse gas emission (United Nations 2018). According to world meteorological organization (WMO) 2023, urban area contains 54% of the world population. The city population is projected to reach 7 billion by 2050 (United Nations 2018). Without decisive action taken on the rate of population growth, it will drive a significant increase in emissions in our cities thereby negatively impacting the environment, human health climate change and sustainability of other life forms (Rivera 2020). Added to urbanization in the cities, buildings operation in the cities contributes 40% to greenhouse gas emission (GHG) Dipta, Uday & Chiewdhurg 2022.

Other human activities include consumption of fossil fuel, deforestation and agricultural practices (WMO 2013, IPCC 2001, Lasalle T.J. & Hepperly P. 2009). Cities concentrate millions of people into locations that can be highly vulnerable to disaster, pollutions and the impact of climate change due to it's high population density (United Nations 2018). Ibadan City with the estimated population of 4.4 million people according to Oyo State Bureau of Statistics 2025 is highly urbanized and highly vulnerable to flooding and other disasters (Eguarage 2015). This conditions make it necessary for the proposed urban resilience through integration of Nbs and innovations. Urban resilience can be operationalized through a range of tools and indices that enable assessment of cities to different shocks and challenges (Martinez et al 2020).

➢ *Aim and Objectives*

This study aims to use the perceptions of experienced and highly skilled professional (expert) in the relevant ministries, Departments and offices as complementary to the facts of the literature on causes of climate change effects and the possibility of using Nbs and innovation to build resilience in Ibadan city. The objectives are to;

- Identify the officers' attributes in terms of years of experience in their job role
- Identify perceived human-induced causes of climate change
- Identify perceived effect of climate change, adaptation & mitigation strategies
- Identify problems associated with adoption of Nbs in Ibadan city
- Proffer suggestions to the government and general public on the importance of Nbs and innovation integration in enhancing city's resilience in general and Ibadan city in particular

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➢ *Justification for the Study*

The stress and shock suffered by the cities as a result of population increase and climate change include flood, power outage pollution, land degradation, outbreak of diseases among others. Yet the world cities is expected to grow from 4 billion in 2028 to 7 billion in 2050 (United Nations 2018). This makes the cities vulnerable to climate change due to anthropogenic activities of people.

Similarly, the rate of population increase in Ibadan city is high according to Oyo State Bureau of statistics 2025, the population is 4.4 million with an average annual growth rate of 2.5%. Therefore this population increase with the attendant climate change problems calls for the integration of Nbs and innovation adoption in an attempt to make Ibadan city resilient. The need for more sustainable urban planning through Nbs and integration of innovations is crucial at this moment because reliance on traditional defensive gray infrastructure (Dams, Pipes Seawalls Levees) among others is increasingly risky, costly, very unreliable and inefficient strategies.

Most extant studies carried out in Ibadan city focused on different areas. For instance, Eguaroje et al (2015) worked on flood vulnerability assessment of Ibadan city. Onifade et al (2014) worked on impact of flood disasters on sustainable development, Ajayi G.O. et al (2012) worked on historical geospatial analysis of flood-prone areas in Ibadan metropolis among others. This study used perceptions of experts from the National Council of Climate Change (NCCC) Nigeria that works directly with state ministry of Environment and other stakeholders in the state to complement the facts of the literature on issue of climate change and city resilience. These bodies implement climate action policy to manage climate-related risks. Also contrary to other studies, the study focuses on the use of Nbs and innovation integration in an attempt to make Ibadan city resilient.

➢ *Study Area*

The study was carried out in Ibadan region, Oyo state cover approximately 8669.418km^2 which constitute 22.18% of Oyo State total land area of 39,077.69km^2 (Lawal et al 2022). Ibadan region is bounded in the North by Afijio local government, in the East Osun and Ogun state, in the south by Ogun state and in the West by Ibarapa East local government and Ogun state (figure 2.1). The entire Oyo state is homogenous and comprises of the Oyos, the Ibarapas and the Ibadans all belonging to Yoruba family and speaking the same Yoruba language.

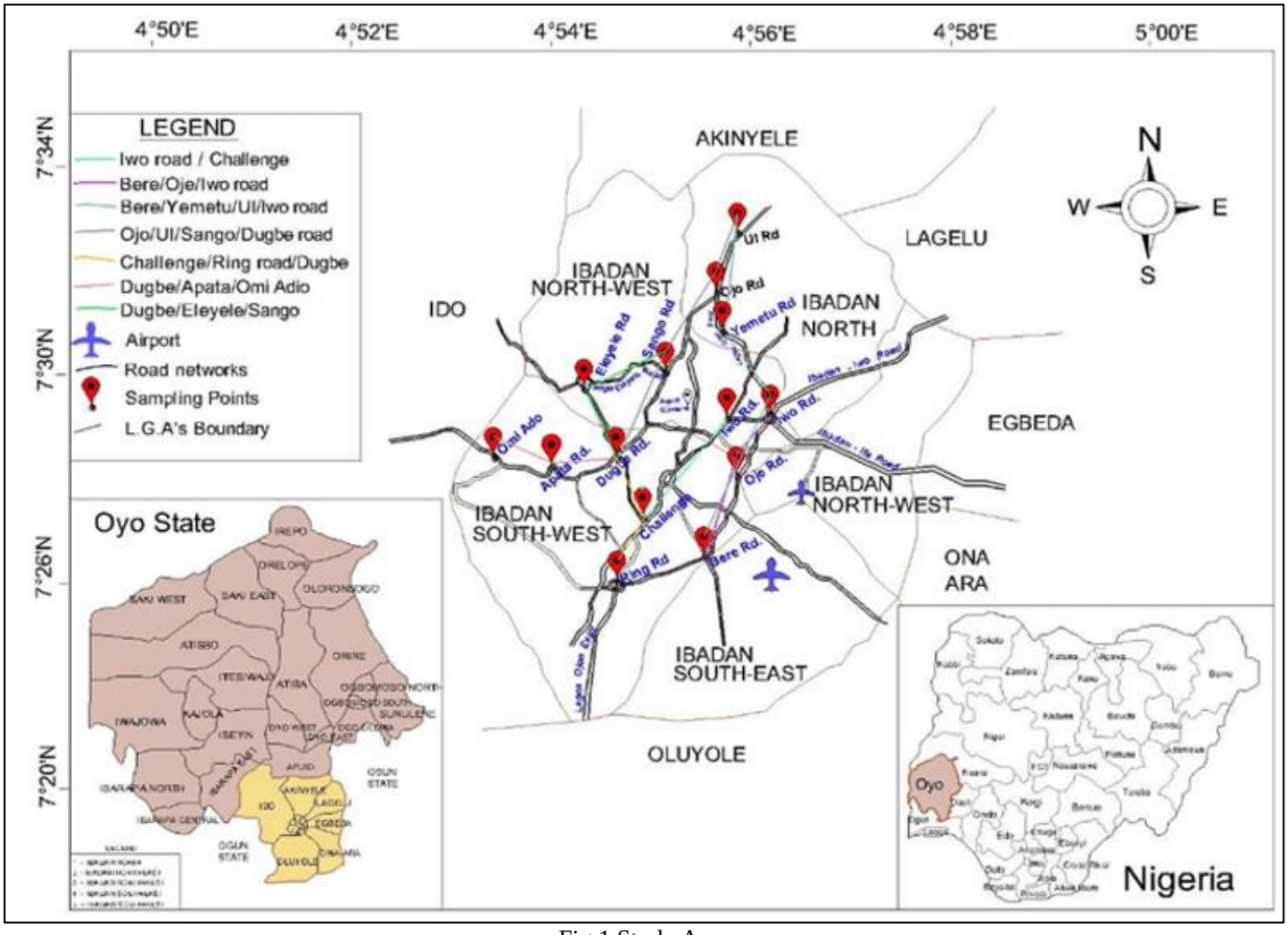

Fig 1 Study Area

Source: https://www.researchgate.net/figure/Map-of-Ibadan-city-in-Oyo-State- Nigeria-showing-the-route-corridors-and-sampling-points_fig1_347727837

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The choice of Ibadan city is because Ibadan is the third largest city in Nigeria. The estimated population of Ibadan metropolitan area in 2025 is approximately 4.4 million (Oyo State Bureau of Statistics 2025). The wider Ibadan region includes the eleven Local Government areas (Ibadan North, South, Northwest, South west, Akinyele, Oluyole, Egbeda, Ido, Lagelu, Ona Ara. The metropolitan area of Ibadan has shown a consistent annual growth rate of approximately 3.3% to 3.6% in recent years (2023 – 2026) given by migration and natural increase (Oyo state Bureau of Statistics 2025). This trend of annual growth in population justifies this study. See table 2.1 below. People from surrounding rural area and even other Nigeria cities move to Ibadan for better job opportunities, education and health.

Table 1Current Population Estimate for Ibadan

S/N	LGA	POPULATION	Estimated Annual Growth Rate (%)
1	Ibadan North	1,200,000	2.5
2	Ibadan North East	1,100,000	2.5
3	Ibadan North West	1,000,000	2.5
4	Ibadan South East	900,000	2.5
5	Ibadan South West	1,300,000	2.5
6	Akinyele	600,000	3
7	Egbeda	700,000	2.5
8	Lagelu	500,000	3
9	Oluyole	800,000	2.5
10	Ona-Ara	700,000	3
11	Ido	600,000	2.5

Source: Oyo state Bureau of Statistics 2025

This population growth have socio-economic and environmental implications (Oyo state Bureau of Statistics 2025)

II. MATERIALS AND METHODS

National council of Climate Change/Oyo State Ministry of Environment and other shareholders in the state such as MLHUD and OYNTCDA who are experts on issue of climate change and choice of these bodies was based on the fact that they implement climate action policy to manage climate-related risks in the state. These are experienced workers/practitioners with varied work experience on their job roles relating to climate change, the effects and mitigation strategies. This study used their view points as complementary to the literature facts. Experts insight can provoke an overview of relevant knowledge in the field and offer solutions based on practical experience and strategies (Pfadenhauer 2009, Meuser & Nagel 2009). Semi-structure interview were administered and purposive sampling procedure was adopted because the study required skilled and experienced respondents who had good knowledge of the subject matter. 50 interviews were prepared and served on these bodies. The interviews were divided into section A & B, section A contains the experts' attributes: such as respondent office, years of work experience, and highest qualification. Section B contains the perceptions of respondents on human-induced causes of climate change, perceived causes of climate change on the city, perceived adaptation and mitigation strategies, perceived Nbs & integration of innovation and lastly problems associated with adopting Nbs in Ibadan.

III. DATA ANALYSIS

The data relating to the attributes of the respondents were analyzed with descriptive statistics (frequency & percentage) whereas the perceptions of the respondents regarding causes of human-induced climate change, the effects adaptation and mitigation strategies and problems associated with adopting Nbs in Ibadan were analyzed with inferential statistics (mean, std and chi-square). It was used to determine if a significant association exists between the categorical variables and the perceptions of the respondents.

- *Demographic Characteristics of the Respondents*

Table 2 Institution| Ministry| Department

S/N	ITEMS	FREQ	PERCENTAGE
1.	Oyo State Ministry of Environment and National Council for Climate Change (NCCC) Nigeria	30	60
2.	Oyo State Ministry of Lands Housing and Urban Department (MLHUD)	10	20
3.	Oyo State New Town and City Development Authority (OYNTCDA)	10	20
	TOTAL	50	100

Most respondents 60% are experts of the ministry of Environment who works closely with National Council for Climate Change (NCCC) Nigeria. Followed by staff of Ministry of Lands Housing and Urban Development (MLHUD) 20% and Oyo State New Town and city developed Authority (OYNTCDA) 20%. These are experts with relevant experience on climate factors affecting Ibadan city resilience.

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Table 3 Highest Qualifications of the Officers

S/N	ITEMS	FREQ	PERCENTAGE
1.	PhD	1	2
2.	MSc, M.Tech	10	20
3.	BSC	30	60
4.	HND	9	18
	TOTAL	50	100

The result above shows that 60% of the respondents had B.Sc degree in their respective disciplines, 2% had PhD; 20% masters and 18% had HND. This result shows that majority of the respondents are highly educated.

Table 4 Officers Work Experience

S/N	ITEMS	FREQ	PERCENTAGE
1.	1 – 10 years	8	16
2.	11 – 15 years	12	24
3.	16 – 20 years	25	50
4.	Above 20 years	5	10
	TOTAL	50	100

The result of the analysis shows that 50% of the experts had long years of experience (16 – 20yrs) followed by 24% (11 – 15years), 16% (1 – 10years) and the least 10% (above 20years). These category of staff are highly experience in their respective job roles.

Table 5 Perceived human-induced causes of climate change

S/N	Categories	SA (%)	A (%)	I (%)	D (%)	SD (%)	x^2	p-value
1	Consumption of fossil fuel	35 (70)	15 (30)	0	0	0	0.000	0.000***
2	Deforestation	38 (76)	12 (24)	0	0	0	13.520	0.000***
3	Urban and industrial expansion	30 (60)	20 (40)	0	0	0	2.000	0.157
4	Overgrazing and fodder harvest	39 (78)	11 (22)	0	0	0	15.680	0.000***
5	Chemical use in farming	40 (80)	10 (20)	0	0	0	18.00	0.000
6	Building operations	34 (68)	7 (14)	9 (30)	0	0	7.160	0.000
7	Mining activities	25 (50)	25 (50)	0	0	0	1.000	0.000
8	Waste burning and air pollutions	50 (100)	0	0	0	0	-	-
9	Construction materials	20 (40)	30 (60)	0	0	0	0.157	0.000
10	Intensive logging for timber	50 (100)	0	0	0	0	-	-

Table 5 presents the descriptive statistics of the respondents and their perceptions about the causes of climate change. The majority of the respondents agreed that most of the listed variables are responsible for climate change. The first row on the table revealed that 70% of the respondents strongly agreed and 30% agreed that consumption of fossil fuel causes climate change with x^2 and probability value of 0.000 and 0.000*** respectively. The second row 38 participants strongly agreed and 12 agreed that deforestation is the cause of climate change with x^2 and p-value 13.520 and 0.000*** respectively. The third row revealed that 60% of the respondents strongly agreed and 40% agreed that urban and industrial expansion are responsible for climate change with x^2 and probability value 2.000 and 0.157 respectively. In the fourth row, 78% of the respondents strongly agreed and 22% agreed that overgrazing and fodder harvest cause climate change with chi-square 15.680 and p-value 0.000***. Chemical use in farming is the fifth option that is responsible for climate change with 80% strongly agreed and 20% agreed with 18.00 chi-square and 0.000 p-value.

The sixth row revealed that 68% strongly agreed and 14% agreed and 16% indifference that building operations are responsible for climate change with 7.160 chi-square and 0.000 probability value. The item on the seventh row revealed that 50% of the respondent strongly agreed and 50% agreed that mining activities are responsible for climate change. Item eight showed that 100% of the respondents strongly agreed that waste burning and air pollution are responsible for climate change. Item nine showed that 40% strongly agreed and 60% agreed that construction materials are responsible for climate change and lastly the tenth item, 100% of the respondents strongly agreed that intensive logging for timber causes climate change.

Table 6 Perceived Impact of Climate Change on the City of Ibadan

S/N	Categories	SA (%)	A (%)	I (%)	D (%)	SD (%)	x^2	p-value
1	Extreme weather events such as flooding, storm and drought	50 (100)	0	0	0	0	-	-
2	Urban heat island	39 (78)	11 (22)	0	0	0	15.620	0.000

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3	Economic disruption	34 (68)	9 (30)	7 (14)	0	0	7.160	0.000
4	Physical and infrastructure deficit	20 (40)	30 (60)	0	0	0	0.157	0.000
5	Migration and urbanization	40 (80)	10 (20)	0	0	0	18.00	0.000
6	Increased threat to livestock and agricultural yield	25 (50)	25 (50)	0	0	0	1.000	0.000

Item one in the first row revealed that 100% of the respondents strongly agreed that the impact of climate change in extreme weather events such as flood, storm and drought. Item two in the second row revealed that 78% of the respondents strongly agreed and 22% agreed that the impact of climate change on Ibadan city is urban heat Island with x^2 15.650 and p-value (0.000). the third row showed that 68% strongly agreed, 18% agreed and 14% indifferent that climate change causes economic disruption in Ibadan. Item four showed that 40% strongly agreed and 60% agreed that climate change causes physical and infrastructure deficit in Ibadan with x^2 0.157 and probability value 0.000 respectively. Item five revealed that 80% of the respondents strongly agreed and 20% agreed that the impact of climate change is urbanization and migration and lastly 50% strongly agreed and 50% agreed that the impact of climate change include increased threat to livestock and agricultural yield.

Table 7 Perceived Mitigation Strategies and Adoption Plans

S/N	Categories	SA (%)	A (%)	I (%)	D (%)	SD (%)	x^2	p-value
1	Carbon sequestration	50 (100)	0	0	0	0	-	-
2	Agroforestry and plantation	50 (100)	0	0	0	0	-	-
3	Tree planting	50 (100)	0	0	0	0	-	-
4	Renewable energy and modern bio-energy usage	25 (50)	25 (50)	0	0	0	1.000	0.000
5	Building and city decarbonization	40 (80)	10 (20)	0	0	0	18.000	0.000
6	Improved infrastructure	30 (60)	20 (40)	0	0	0	0.157	0.000
7	Green space preservation	39 (78)	11 (22)	0	0	0	15.650	0.000
8	Sustainable urban planning	12 (100)	38	0	0	0	13.520	0.000
9	Land swarp initiatives	0	50 (100)	0	0	0	-	-
10	Flood control, drainage and channelization	25 (50)	25 (50)	0	0	0	1.000	0.000
11	Bridges and culvert reconstruction	25 (50)	25 (50)	0	0	0	1.000	0.000
12	Community and engagement and capacity building	20 (40)	30 (60)	0	0	0	0.157	0.000
13	Building regulations	50 (100)	0	0	0	0	-	-

The first item showed that 100% of the respondent strongly agreed that carbon sequestration is the mitigation strategy for climate change. Also, the 2nd and 3rd items 100% of the respondents strongly agreed that agro-forestry & plantation and tree planting are the adaptation plans for climate change respectively. The fourth item shows that 50% strongly agreed and 50% agreed that the use of renewable energy and modern bio-energy are the mitigation strategies for climate change. The fifth item revealed that 80% strongly agreed and 20% agreed that building and city decarbonization are strategies for mitigating climate change with x^2 18.00 and p-value 0.000 respectively. The sixth item showed that 60% strongly agreed and 40% agreed that improved infrastructure is adaptation plans for climate change. In item seven 78% strongly agreed and 22% agreed that green space preservation is a good adaptation plan employed for climate change in Ibadan City with x^2 15.680 and p-value 0.000 respectively. Item eight on the table revealed that 24% strongly agreed and 76% agreed that sustainable urban planning is a strategy employed for climate change with x^2 13.520 and p-value 0.000. Item nine 100% of the respondent agreed that land swarp initiatives are adaptation plan for climate change. In item ten 50% strongly agreed and 50% agreed that flood control drainage and channelization in Ibadan city are strategies for climate mitigation and adaptation plans. Also in item eleven on the table 50% strongly agreed and 50% agreed that bridges and culvert construction include adaptation plans employed in Ibadan city for climate change. Item twelve

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showed that 40% strongly agreed and 60% agreed that community engagement and capacity building are strategies good for climate change adaptation and mitigation. Lastly, the last item on the table 50% strongly agreed and 50% agreed that building regulations are potent for adaptation plan and climate mitigation in Ibadan City.

Table 8 Perceived Nature-Based Solutions for Making Ibadan City Resilient

S/N	Categories	SA (%)	A (%)	I (%)	D (%)	SD (%)	x^2	Rank
1	By using green infrastructure for flood management and combat heat island	7 (14)	43 (86)	0	0	0	1.14	5
2	Smart city tools for real time monitoring and warning systems	34 ()	16	0	0	0	1.68	1
3	Combining climate risk data with urban development projects	40 (80)	10 (20)	0	0	0	1.2	4
4	Blue carbon ecosystem by using electric vehicles in the city	21 (42)	29 (58)	0	0	0	1.42	2
5	To reduce emission of GHG	26 (52)	19 (38)	5 (10)	0	0	1.32	3

Five options were given through which nature-based solutions could be used and they are ranked in order of importance. The respondent ranked the use of smart city tools for real time monitoring and warning systems as the 1st modern way of using Nbs with a mean of 1.68. the second among the listed option in blue carbon ecosystem where 42% strongly agreed and 58% agreed with the option. The third is by using renewable energy such as solar in the city and vehicles instead of fossil fuel. 52% strongly agreed, 38% agreed and 10% indifferent to this option. Combining climate risk data with urban development projects was ranked 4th with 80% strongly agreed and 20% agreed with the option. The last option which was ranked 5th was by using green infrastructure for flood management and combat heat Island where 14% strongly agreed and 86% agreed with the option.

Table 9 Perceived Problems Associated with Nature Based Solutions (NBS) and Innovation Adoption in Ibadan city

S/N	Categories	SA (%)	A (%)	I (%)	D (%)	SD (%)	x^2	Rank
1	The misconception is that NBS projects are difficult to fund compared to traditional grey infrastructure	34 ()	11 ()	5	0	0	1.48	4
2	Expansion of built up area (unplanned) drastically reduced green space and natural absorption areas	46	4	0	0	0	1.92	2
3	There is a lack of technical knowledge and expertise on planning and implementing NBS	10	0	8	32	0	1.32	5
4	Unregulated expansion makes it difficult to allocate space for green infrastructure	35	12	3	0	0	1.74	3
5	Lack of awareness and evidence among residents and policy makers about the benefits of NBS in preference to ‘hard’ engineering solutions	34	11	5	0	0	2	1

Table 9 above is on problems associated with nature based solution and innovation adoption in Ibadan city. The experts ranked lack of awareness and evidence among residents and policy makers about the benefits of NBS in preference to hard engineering solution with a mean (2) first among the listed options. Expansion of built-up areas (unplanned) drastically reduced green space and natural absorption areas was ranked second problem with mean (1.92). The third which is similar to the second is that unregulated expansion makes it difficult to allocate space for green infrastructure. The fourth was the misconception by the people that Nbs projects are difficult to fund compared with traditional grey infrastructure (1.48). Lastly in the rank is lack of technical knowledge and expertise on planning and implementation of Nbs.

IV. CONCLUSION AND RECOMMENDATION

Nature-based solutions are actions to protect, sustainably manage or restore natural ecosystems that address societal challenges such as climate change, human health, food and water security and disaster risk reduction effectively and adaptively simultaneously providing human well-being and biodiversity benefits (World Bank 2022). This study examined the perceptions of experts as supplementary to the literature on the importance of Nbs in making Ibadan city resilient. This has provided insightful knowledge to the

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residents, professionals and policy makers on the importance of Nbs in preference to the traditional grey strategies of adaptation and mitigation.

Nbs such as tree planting and plantation crops have great potential to sequester atmospheric carbon and mitigate global climate change. Therefore, it is recommended that there is an urgent need to properly integrate trees and plantation in our agricultural systems, homes, institutions, markets, parks and other public places. Studies suggest that nature-based solutions can provide 37% of the mitigation needed until 2030 to achieve the targets of the Paris agreement (World Bank 2022).

Secondly, the government should implement nature base solutions such as climate smart farming, environmentally sustainable forest management, restoration of wetlands and degraded forests as some of the interventions seeking to improve the water quality of the lake.

Thirdly, to make Ibadan city resilience focus should be placed on the vulnerable areas such as development of green infrastructures, improving flood mapping, enforcing land-use regulations and strengthening community based disaster management.

And lastly dependence on fossil fuel should be discontinued and replaced with renewable energy in order to reduce carbon emissions in the cities.

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