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VULNERABILITIES OF REAL ESTATE SECTOR TO CLIMATE CHANGE IN THE FEDERAL CAPITAL TERRITORY, NIGERIA

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ABSTRACT: The real estate sector in Nigeria's Federal Capital Territory (FCT) is increasingly vulnerable to climate change impacts, posing significant risks to properties, investments, and human settlements. This study investigates the vulnerabilities of the real estate sector to climate change in the FCT, and identifies adaptation strategies employed by real estate enterprises. A survey design was used, and data were collected from firms through household questionnaires, focus group discussions, expert interviews and observations. A stratified and simple random sampling techniques were used to select 60 estate development firms for the study. Data analyses were conducted using descriptive and inferential statistics, including Spearman correlation coefficient, standard deviation, and Z-score, to generate descriptive statistics, rank variables, and perform comparative analyses. The findings reveal that flooding is the most pressing climate-related issue affecting the sector, ranked 1st with a Z-score of 1.47, followed by reduced property values, property damage and loss, and inadequate climate change policies. Moreover, the study shows that the FCT's real estate enterprises adapt to climate change through flood protection measures, climate-resilient building designs, renewable energy systems, water conservation measures, and green infrastructure. This study concluded that the real estate sector in the Federal Capital Territory (FCT), Nigeria, is highly vulnerable to climate change, particularly flooding. The study recommends investing in flood risk management infrastructure and developing climate-resilient building codes and policies to promote sustainable development in the FCT's real estate sector and beyond.

Keywords: Climate Change Vulnerability, Real Estate Sector, Flood Risk Management, Climate Adaptation Strategies, Sustainable Urban Development

INTRODUCTION

The real estate sector faces substantial threats from climate change, with profound implications for property values, development projects, and the broader economy. Research globally has

highlighted the significant impacts of climate change on the real estate sector (McKinsey, 2022; Journal of Urban Economics, 2017; McKinsey Global Institute, 2020). Studies have shown that extreme weather events, exacerbated by climate change, can damage infrastructure and affect property values (Cheng et al., 2022). Poor urban planning and inadequate drainage systems can worsen flood risks, leading to property damage and business disruptions (Adeleke, 2016; Adewale, 2017; FMoE, 2015). Furthermore, climate change can increase energy consumption, heat-related illnesses, and compromise building integrity due to inadequate climate-resilient construction practices (IPCC, 2013; Oyekale, 2018; NEST, 2017; UN-Habitat, 2016).

The real estate sector faces significant climate-related risks, including increased frequency and severity of natural disasters, which can damage properties and disrupt businesses (IPCC, 2022; Swiss Re, 2022). Climate change impacts are already being felt, with physical and transition risks threatening real estate asset values and cash flows (UNEP FI, 2022). Extreme weather events, such as hurricanes, floods, and wildfires, can cause substantial damage to properties in vulnerable areas (CoreLogic, 2021; First Street Foundation, 2022). The sector is responsible for around 40% of global greenhouse gas emissions, making it a significant contributor to climate change (UNEP FI, 2022).

According to recent studies, climate change impacts are already being felt, with physical and transition risks threatening real estate asset values and cash flows (UNEP FI, 2022; CoreLogic, 2021). Specifically, extreme weather events such as hurricanes, floods, and wildfires can cause substantial damage to properties in vulnerable areas, resulting in significant economic losses (NOAA, 2022; First Street Foundation, 2022). Furthermore, the sector's significant contribution to global greenhouse gas emissions - around 40% - makes it a key player in climate change mitigation efforts (Global Alliance for Buildings and Construction, 2020; IEA, 2020). Recent research highlights the importance of incorporating climate change risks into real estate investment decisions and asset valuations (Fisher et al., 2021; Four Twenty Seven, 2020). By doing so, investors and developers can better manage climate-related risks and capitalise on opportunities in sustainable and climate-resilient real estate development.

Despite growing awareness of climate change implications, the FCT remains vulnerable to its impacts, which threaten property values, infrastructure, and human settlements. Rapid urbanisation and inadequate planning in the region exacerbate these risks (Akinwumi, 2015; Falade, 2018; NEST, 2017). While previous studies have examined climate change impacts on real estate, there is a need for more research on vulnerability assessment and mitigation strategies in the FCT, Nigeria. This study addresses this gap by investigating real estate vulnerabilities to climate change and exploring strategies for climate-resilient development in the FCT.

The Federal Capital Territory (FCT), Nigeria, faces significant climate-related challenges, including increased temperatures, flooding, and droughts, which compromise the resilience of its real estate sector. Unplanned urbanisation and inadequate infrastructure development in the FCT amplify these vulnerabilities, posing substantial threats to property values, infrastructure integrity, and human well-being (Adeleke, 2016; Adewale, 2017; IPCC, 2013; UN-Habitat, 2016). The recent flooding incidents in Trademore and Efa estates (Omoera & Guanah, 2022; Ariemu, 2023) underscore the urgent need for climate-resilient strategies in real estate development. Furthermore,

climate change imperils real estate assets and value (Cheng et al., 2022), while poor drainage systems and inadequate urban planning heighten flood susceptibility (Adewale, 2017; FMoE, 2015). Limited access to climate data and early warning systems also constrains adaptive capacity (FMoE, 2015; IFRC, 2019).

Extensive research has highlighted the global vulnerability of real estate to climate change (IPCC, 2014; UNEP FI, 2020), yet the specific vulnerabilities of Nigeria's Federal Capital Territory (FCT) real estate sector remain understudied (Adelekan, 2010; Etuonovbe, 2011). Although climate change impacts on real estate have been documented in various contexts (Agwu & Okhimamhe, 2015; Four Twenty Seven, 2020), the FCT's unique climate, geography, and urbanisation dynamics necessitate focused research (Abubakar & Aina, 2018). Recognising the sector's specific vulnerabilities is essential for developing effective adaptation and mitigation measures (IPCC, 2014). Thus, this study examines the FCT's real estate sector vulnerabilities to climate change and identifies adaptation strategies employed by real estate enterprises.

MATERIALS AND METHODS

The Federal Capital Territory (FCT), spanning approximately 8,000 km², is situated between latitudes 7°25′ and 9°20′N and longitudes 5°45′ and 7°39′W (Nigeria's Federal Government, 1979). Located at Nigeria's centre, the FCT is bordered by Kaduna State to the north and Niger State to the west. Abuja, the capital city, experiences a tropical wet and dry climate (Köppen's Aw classification), characterised by a dry season from November to March and a wet season from April to October (World Climate Guide, 2020). Annual rainfall averages around 1,632 mm, with peak rainfall occurring in July, August, and September (World Climate Guide, 2020). Temperatures range from 32°C to 34°C, with a mean annual temperature of 25.7°C.

The FCT has undergone rapid urbanisation, driven by a large influx of people, resulting in the emergence of satellite towns such as Karu Urban Area, Suleja, and Gwagwalada (Abubakar & Aina, 2018). The metropolitan area's population was estimated at six million persons in 2016, making it Nigeria's second-most populous metro area (UN-Habitat, 2016). This rapid growth has created a high demand for estates, requiring significant financing and integration of sustainable principles (Agbola & Agbelade, 2017).

This study employed a survey design, utilising both primary and secondary data sources. A sample of 60 estate development firms (53% of the population) was selected from a total of 113 firms in the Federal Capital Territory (FCT), Abuja, using stratified and simple random sampling techniques. This approach ensured a representative sample by dividing the population into three distinct subgroups (large, medium, and small) of firms. Large firms in real estate are those characterised by significant market share and substantial financial resources. Medium-sized firms have an established presence and moderate-sized portfolios. Small firms typically have limited market presence and restricted financial resources.

Data collection involved questionnaires, observations, expert interviews, and focus group discussions. The questionnaire was structured to cover the study's objectives, including vulnerabilities of real estate to climate change, and current adaptation strategies. Data analysis was

conducted using descriptive and inferential statistics, including Spearman correlation coefficient, standard deviation, and Z-score, to address the study's objectives. The results were presented in tables and discussed in line with existing knowledge and theories.

RESULTS AND DISCUSSIONS

The vulnerabilities of the real estate sector to climate change in the FCT are presented in Table 1. Table 1 shows the ranks and Z-scores for vulnerability variables such as temperature fluctuations, flooding, water scarcity, soil erosion, increased maintenance costs, reduced property values, property damage and loss, increased insurance costs, displacement and migration, health risks, psychological stress, inadequate climate change policies, insufficient climate change awareness, and ineffective governance.

Table 1: Vulnerabilities of the Real Estate Sector to Climate Change in FCT

Z-Score	Frequency	Rank	Z-Score
Temperature fluctuations	46	10	-0.12
Flooding	60	1	1.47*
Water scarcity	50	5	0.33
Soil erosion	48	9	0.11
Increased maintenance costs	50	5	0.33
Reduced property values	57	2	1.13*
Property damage and loss	55	3	0.90*
Increased insurance costs	49	8	0.22
Displacement and migration	40	11	-0.81
Health risks	40	11	-0.81
Psychological stress	32	13	-1.72
Inadequate climate change policies	52	4	0.56*
Insufficient climate change awareness	30	14	-1.94
Ineffective governance	50	5	0.33

It shows that flooding ranked 1st among the real estate climate change vulnerability variables followed by reduced property values, property damage and loss, inadequate climate change policies and the least is insufficient climate change awareness. The Z- score also shows that flooding (Z=1.47), reduced property values (Z= 1.13), property damage and loss (Z= 0.90), inadequate climate change policies (Z= 0.56), scored above average. Thus, flooding, reduced property values, property damage and loss, inadequate climate change policies are the major climate change vulnerability issues to the real estate sector in the FCT Nigeria. This result imply that flooding is the major climate change related issue that expose the real estate sector to dangers.

The findings of this study align with previous research on climate change vulnerabilities in the real estate sector. The result is consistent with IPCC (2018) and NIMET (2020) reports on flooding in Nigeria. It also supports findings by Adelekan (2016) on temperature-related health risks in Nigeria. It is consistent with World Bank (2019) report on economic impacts of climate change in

Nigeria. It agreed with the findings by Oyedele (2018) on climate-related maintenance costs in Nigerian buildings. It also aligns with the International Monetary Fund (IMF) (2020) report on climate-related economic risks. It corroborates the UNFCCC (2019) report on climate policy gaps in Nigeria.

Table 2: Strategies Used by Real Estate Enterprises to Adapt to Climate Change in the FCT

Flood protection measures	Frequency	Mean	Percentage score
Levees	23		
Floodwalls	32	37.67	23.23
Drainage systems	58		
Climate-resilient building designs			
Elevated foundations,	37		
Waterproofing,	45		
Wind-resistant	46	36.00	22.20
Window to wall ratio	40		
Orientation to wind direction	30		
Local material preference	18		
Renewable energy systems			
Solar panels	46		20.04
Wind turbines	19	32.5	
Water conservation measures			
Rainwater harvesting	30	26	16.03
Greywater reuse	22		
Green infrastructure			
Green Roof	20		18.50
Green spaces	40	30	

The ways by which real estate enterprises in the FCT currently adapt to climate change are presented in Table 2. Table 2 shows that real estate enterprises in the FCT currently adapt to climate change through the following: flood protection measures (23.23%), climate-resilient building designs (22.20%), renewable energy systems (20.04%), water conservation measures (16.03%), and green infrastructure (18.50%).

The result that climate change poses significant risks to the real estate sector in the FCT is consistent with previous studies (IPCC, 2018; UN-Habitat, 2019). Fluctuations in temperature and precipitation patterns can lead to increased maintenance costs, reduced property values, and property damage or loss. Flooding, a major concern in the FCT, is exacerbated by climate change (NOAA, 2020). Heavy rainfall events, such as the 2012 floods, result in significant economic losses and displacement of residents (World Bank, 2019). Water scarcity, another pressing issue, affects property values and human health (GWP, 2019). Droughts can lead to reduced water supply, impacting residential, commercial, and industrial properties. Soil erosion, exacerbated by

climate change, threatens property foundations and structural integrity (UNEP, 2019). Landslides and soil degradation can render properties uninhabitable.

Previous studies highlight increased maintenance costs due to climate-related events (JLL, 2020). Property owners and managers must invest in climate-resilient materials and designs. Reduced property values and property damage or loss are direct consequences of climate-related events (CBRE, 2020). Flooding, landslides, and extreme weather damage can render properties uninsurable or unsellable. Inadequate climate change policies, insufficient awareness, and ineffective governance exacerbate vulnerabilities (OECD, 2020). Weak regulations and a lack of enforcement hinder climate-resilient development.

Effective adaptation strategies, such as climate-resilient urban planning and green infrastructure, can mitigate vulnerabilities (UN-Habitat, 2019). Public-private partnerships and stakeholder engagement are crucial for implementing climate-resilient solutions.

The finding is Consistent with IPCC (2018) recommendations on flood risk management. It aligns with UN-Habitat (2019) guidelines on climate-resilient urban planning. The result supports IEA (2020) reports on renewable energy adoption. It is consistent with World Bank (2019) recommendations on water management. It aligns with TNC (2019) findings on green infrastructure benefits.

Conclusion and Recommendations

Based on the findings, it can be concluded that the real estate sector in the Federal Capital Territory (FCT), Nigeria, is highly vulnerable to climate change, particularly flooding, reduced property values, property damage and loss, and inadequate climate change policies. The sector's adaptation strategies are multifaceted, with a focus on flood protection measures, climate-resilient building designs, renewable energy systems, water conservation measures, and green infrastructure.

Thus, two key recommendations are proposed. Firstly, investing in flood risk management infrastructure, such as drainage systems, flood barriers, and green spaces, can help reduce the impact of flooding on real estate properties in the FCT. Secondly, developing and enforcing climate-resilient building codes and policies that incorporate adaptation strategies, such as climate-resilient building designs, renewable energy systems, and water conservation measures, can help reduce the vulnerability of real estate properties to climate change impacts and promote sustainable development in the FCT.

These findings highlight the need for policymakers and stakeholders to prioritise climate-resilient development, enhance policy frameworks, and promote sustainable practices in the real estate sector to mitigate the impacts of climate change. By doing so, the sector can reduce its vulnerability and contribute to sustainable development in the FCT.

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