A SYSTEMIC REVIEW ON URBAN HEAT ISLAND STUDIES IN NIGERIA

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Abstract
The ever-increasing temperatures due to global warming are not just an abstract concept; they have tangible consequences for daily lives. As temperatures rise globally, the way we design and construct our surroundings becomes crucial in mitigating the impacts of heat waves and reducing overall carbon emissions. This paper aimed to review existing relevant literature on understanding the urban heat island effect on neighbourhood scale towards enhancing eco-friendly residential neighbourhood. A systematic literature review methodology was employed. The results shows the causes of urban heat island effect and mitigation strategies. These strategies aim to mitigate the Urban Heat Island (UHI) effect by focusing on increasing vegetation cover, using reflective surfaces, and adjusting building design to promote better air circulation and cooling; essentially reducing the amount of heat absorbed and trapped within urban areas.

Keywords: Climate Change, Urban Heat Island, Urban Heat Island Effect, Urban Neighbourhood, Mitigation

Introduction

The ever-increasing temperatures due to global warming are not just an abstract concept; they have tangible consequences for our daily lives, especially for the built environment, architecture, and environment, global warming heat waves are increasingly pertinent in the context of climate change. As temperatures rise globally, the way we design and construct our surroundings becomes crucial in mitigating the impacts of heat waves and reducing overall carbon emissions (Ahmed et al., 2020; Huang et al., 2018; H. Wang et al., 2018).

Climate change is one of the most widely discussed topics and constitutes one of the greatest threats to humanity of our time (Allu, 2014). As a result, the term and its implications have experienced growing media attention worldwide and have become increasingly known to a wider public (Kunelius & Roosvall, 2021). Simultaneously, the concept of green building i.e., a building that minimizes or eliminates negative environmental impacts has emerged. The building sector significantly contributes to global energy consumption and carbon dioxide emissions (Ahmed et al., 2020). This is largely due to the use of non-renewable energy resources and poor building design (Huang et al., 2018). To address this, there is a need for a paradigm shift in understanding and behaviour change, with a focus on sustainable design, low-carbon construction practices, and renewable technologies (Kotharkar et al., 2020). Hence the sector has been an integral part of global efforts to reduce the negative impact of climate change and greenhouse emissions on the environment (J. Wang et al., 2023).

Urban neighborhoods are a major source of global energy consumption and carbon emissions, playing a significant role in climate change. They account for a substantial portion of global energy use (67-76%) and CO2 emissions from global final energy use (71-76%). This makes addressing energy consumption and emissions in urban areas crucial for achieving global sustainability goals. The consumption of energy and the associated emission of greenhouse gases and particulate matter have implications on a large-scale and long-term climate, especially for megacities that struggle with air pollution and toxic clouds of smog over extended periods which make living in these cities increasingly unhealthy(Ahmed et al., 2020). All over the world, research in urban climatology is needed to provide resilient, liveable, and healthy spaces for city dwellers. Moreover, Sustainable Cities and Communities is one of the United Nations' 17 Sustainable Development Goals (Allu, 2014). However, the focus of research activities in urban climatology is neither geographically, nor thematically equally distributed. Of the many mitigation strategies to avert the effect of climate change, mitigation of heat waves (UHI) is one of them (Jaiye, 2020).

A range of studies have explored strategies to mitigate the Urban Heat Island (UHI) effect. Cheela et al., (2021); Christian, (2013); Nwakaire et al., (2020) emphasizes the use of innovative urban pavements, while Balany et al., (2020); Wong et al., (2021) suggests land management and plant cover as key strategies. Moulai et al., (2019) highlights the role of green spaces and increased albedo in reducing UHI, with successful examples in London and New York City. Solecki et al., (2005) underscores the potential benefits of urban vegetation and reflective roofs in reducing health hazards and energy consumption.

The design of buildings and neighbourhood spaces significantly influences the absorption, retention, and release of heat(Abulibdeh, 2021). Materials like concrete and asphalt possess high thermal mass, meaning they have a strong ability to absorb, store, and release heat. This property makes them useful in various applications, including building construction and pavement, where they can help regulate indoor temperatures and manage heat storage. Conversely, incorporating green spaces, utilizing reflective surfaces, and designing buildings for natural ventilation can help mitigate heat absorption and reduce the urban heat island effect (Irfeey et al., 2023). Beyond individual buildings, urban neighbourhood planning also plays a vital role in heat mitigation. Creating walkable, tree-lined streets, promoting mixed-use development, and prioritizing public transportation can reduce reliance on cars and the associated heat emissions. Additionally, incorporating urban wetlands, parks, and green corridors can create cooler microclimates within cities. Incorporating climate resilience into city planning processes involves prioritizing green

infrastructure, promoting mixed land use, and enhancing public transportation networks (Abulibdeh, 2021; Chun & Guldmann, 2018; Wang et al., 2021)

With the adverse effect of urban heat waves and the need to devise mitigation strategies for enhancing eco-friendly neighborhoods, improving thermal comfort and combating the effect of climate change. This paper aimed to review relevant literature to ascertain the currently researched mitigation strategies on studies done in Nigerian context. This was achieved through a systematic literature review of published academic researchers from reputable journals worldwide. It identifies and analyse currently researched mitigation strategies within the Nigerian context, focusing on relevant literature and identifying research gaps. The goal is to provide a baseline for future research and improve sustainable development. The paper reviews existing studies on climate change mitigation in Nigeria, focusing on strategies to reduce greenhouse gas emissions and enhance climate resilience. It examines the research trends, geographic distribution, and effectiveness of these strategies.

Methodology

A systematic review of urban heat island (UHI) studies in Nigeria involves a methodical approach to identify, assess, and synthesize relevant research on the topic. The methodology typically includes defining inclusion and exclusion criteria for studies, searching databases and grey literature, extracting data using standardized forms, and performing meta-analysis or narrative synthesis of the findings. Papers were categorised according to the location of studies and analysed in that respect.

Keywords used in the search include "urban heat island," "Nigeria," "remote sensing," "GIS," "land surface temperature," and related terms.

Defining Inclusion/Exclusion Criteria:

This involves criteria like:

a. **Geographic Scope:** Studies focused on Nigeria.
b. **Research Type:** Studies uses remote sensing, GIS, field measurements to assess UHI effects.
c. **Study Design:** Employing systematic approaches, including specific methods for data collection and analysis.

Search Strategy:

a. Database Searches: Utilize online databases like Scopus, Web of Science, Google Scholar, and potentially specialized environmental databases.
b. Grey Literature Search: Explore journals, reports, theses, and other non-traditional sources.
c. Search Terms: keywords “urban heat island," "Nigeria," "LST," "remote sensing," "GIS," "land use/land cover," and "urban heat island intensity"

Factors influencing UHI

Urban Heat Island (UHI) intensity is influenced by a combination of meteorological factors and environmental features. Key contributors include building materials, vegetation, and the surrounding environment, as well as meteorological conditions like wind speed and solar radiation.

Mitigation strategies:

Mitigation strategies are plans to reduce or eliminate the impact of potential risks or hazards. They involve identifying potential threats, developing cost-effective strategies, and maintaining readiness. Common approaches include avoidance, reduction, transference, and acceptance.

a. **Avoidance:**

This strategy involves taking measures to completely eliminate the risk from occurring. For example, if a project relies on a specific, unreliable supplier, you might choose to find an alternative supplier to avoid the risk of delays.

b. **Reduction:**
This involves taking steps to lessen the likelihood of a risk happening or the impact it would have if it does occur. For example, if there's a risk of a cyber-attack, you might implement stronger security measures, such as firewalls and intrusion detection systems, to reduce the likelihood of a successful attack.

c. **Transference:**
This strategy involves shifting the responsibility for a risk to another party, often through insurance or contracts. For example, if a business is at risk of financial losses due to natural disasters, they might purchase insurance to transfer that risk to an insurance company.

d. **Acceptance:**
This involves acknowledging the risk and deciding to manage it without taking any further action, potentially because the risk is low, or the cost of mitigation is too high. For example, a company might accept the risk of a minor delay in a project if the cost of implementing a mitigation plan

Result and Discussion

The urban heat island effect was studied in Nigeria as Nigeria was also faced with climate change challenges like other nations worldwide. Articles selected for the review process are shown in Table 1, with the authors, title, as well as the location where the study was conducted.

Table 1. Showing the list of authors, title and location of article reviewed.

S/n	Author(s)	Title	Location
1	Balogun et al., 2012	Observed urban heat island characteristics in Akure, Nigeria.	Ondo
2	Umar and Kumar, N.D.	Spatial and Temporal Changes of Urban Heat Island in Kano Metropolis, Nigeria.	Kano
3	Adinna et al., 2009	Assessment of urban heat island and possible adaptations in Enugu urban using Landsat-ETM	Enugu
4	Enete et al., 2012	Tree Canopy Cover Variation Effects On Urban Heat Island In Enugu City, Nigeria.	Enugu
5	Tanko et al., 2017	Urbanisation Effect on the Occurrence of Urban Heat Island over Kano Metropolis, Nigeria.	Kano
6	Adeyeri et al., 2017	Investigating Surface Urban Heat Island Characteristics over Abuja, Nigeria: relationship between land surface temperature and multiple vegetation indices.	Abuja
7	Abur et al., 2018	Mitigating Urban Heat Islands in Abuja, Nigeria: Adopting Cool Pavement Technology – A Review	
8	Chibuike et al., 2018	Assessment Of Green Parks Cooling Effect On Abuja Urban Microclimate Using Geospatial Techniques.	Abuja
9	Adewara and Oyewole, 2019	Dynamic Effects of Urban Heat Island in Ilaro Town, Yewa South LGA of Ogun, Southwest Nigeria.	Ogun
10	Esae, 2020	Assessment Of Urban Heat Island Situation In Awka.	Anambra
11	Isioye et al., 2020	Urban Heat Island Effects and Thermal Comfort in Abuja Municipal Area Council of Nigeria	Abuja
12	Bassett et al., 2020	The Megacity Lagos and Three Decades of Urban Heat Island Growth.	Lagos
13	Popoola et al., 2022A	Spatio-temporal variance and urban heat island in Akure, Nigeria: A time-spaced analysis Using GIS Technique.	Ondo
14	Popoola, et al., 2022B	Green Infrastructure Measures to Mitigate the Urban Heat Island of Ibeju Lekki, Lagos, Nigeria	Lagos

15	Ofordu et al., 2022	Urban Heat Island and Land Use/Cover Dynamics Evaluation in Enugu Urban, Nigeria.	Enugu
16	Usman et al., 2023	Spatial And Temporal Changes of Urban Heat Island in Jos Metropolis, Plateau State, Nigeria.	Plateau

Spatial and temporal changes of urban heat island was studied at different locations(as seen in figure 1); Kano, Akure, and Jos (Popoola et al., 2022; Umar & Kumar, N.D.; Usman et al., 2023). A study on the use of green infrastructures to mitigate the effect of urban heat island was also conducted by (Popoola, et al., 2022) at Ibeju Lekki, Lagos Nigeria.

The table 2 shows the number of studies in Northeast (NE), Northwest (NW), North Central (NC), Southeast (SE), Southwest (SW) and South-South (SS). Southern Nigeria above 60% having the highest percentage of the reviewed article.

Table 2. Showing number of studies in Northern Nigeria and Southern Nigeria

Northern Nigeria				**Southern Nigeria**		
Abuja	NE	NW	NC	SE	SW	SS
3	0	2	1	4	5	0

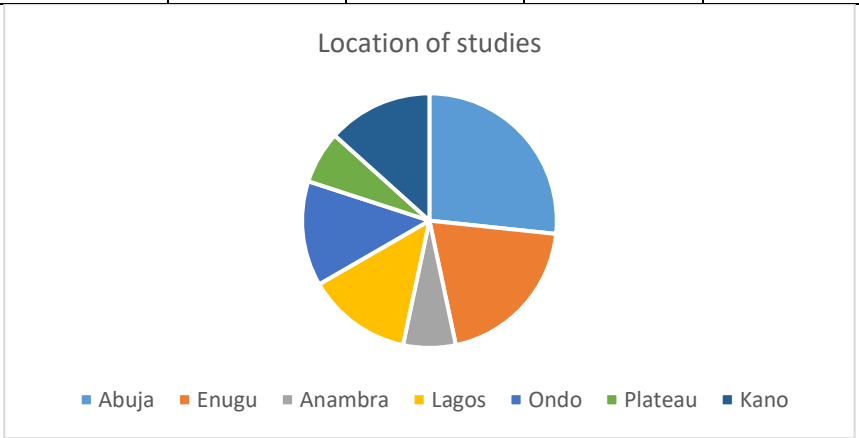

Figure 1; Shows the location of the studies reviewed

Ofordu et al., (2022) studied the dynamics of Land Use/Land Cover and it effect on urban heat island in Enugu Nigeria while tree canopy cover variation effects on urban heat island in Enugu was studied by (Enete et al., 2012) and Adinna et al., (2009) assesses urban heat island and possible adaptation strategies in Enugu. Abur et al., (2018) conducted a review on the use of cool pavements as a mitigation strategy of the effect of urban heat island in Abuja, Nigeria.

Table 3 shows the methodologies, employed by different authors and the aim of the studies under review. This will inform other researchers of the possible methodological approaches to be adopted.

Table 3; shows the aim and methodologies adopted by the reviewed articles.

S/n	**Research**	**Aim**	**Methodology**
1	Balogun et al., 2012	To observe the urban heat island characteristics in Akure.	Field observation
2	Umar and Kumar, N.D.	The study investigates the spatial and temporal pattern and changes of urban heat island (UHI) in Kano metropolis, Kano state Nigeria.	Remote sensing and GIS
3	Adinna et al., 2009	The study investigates the application of Landsat-ETM in the study of UHI.	Remote sensing and GIS.

4	Enete et al., 2012	The study seeks to determine the contributions of street trees in Enugu Urban in ameliorating urban heat Island.	Physical(field) Measurements and Monitoring of temperature under street trees
5	Tanko et al., 2017	The effect of urbanisation on the occurrence of UHI in Kano metropolis was investigated.	Model Maker in Earth Resource Development Assessment System (ERDAS) Imaging 14 software.
6	Adeyeri et al., 2017	The study is aimed at investigating urban heat island over Abuja based on the relationship between land surface temperatures.	Landsat 8 Thermal Infrared Sensor (TIRS) band and four vegetation indices from Landsat 8 Operational Land Imager (OLI) bands
7	Abur et al., 2018	To review the strategies to reduce the heat-island effect that are among the climate change mitigations being considered by cities around the world.	Literature review
8	Chibuike et al., 2018	To assess green parks cooling effect on Abuja urban microclimate using geospatial techniques.	Geospatial techniques
9	Adewara and Oyewole, 2019	To examine the dynamic effect of Urban Heat Island in Ilaro town in Ogun state, Nigeria.	Supervised classification algorithm in ENVI-Met simulation software.
10	Esae, 2020	The study was aimed towards studying urban heat island situation in Awka, Anambra state.	Measurement of Transect and fixed temperature to determine spatial extent of UHI in Awka.
11	Isioye et al., 2020	Evaluation of the ecological impact of UHI effect of Abuja Municipal area.	Use of Landsat 8 data
12	Bassett et al., 2020	To explore the impact of Lagos's recent urbanization on its UHI.	Simulation (*ENVI-Met*)
13	Popoola et al., 2022	To gain insights on the Urban Heat Island (UHI) phenomenon in a medium sized city of Akure, Nigeria.	Structured questionnaires/simulation using ArcGIS 10.5.
14	Popoola, et al., 2022	To analyse the UHI effect in Ibeju Lekki, Lagos, Nigeria with the view to recommending green infrastructure to mitigate its impact in the light of rapid urbanization rates.	Using multi-temporal Landsat imageries to generate land surface temperature (LST) and land use/land
15	Ofordu et al., 2022	The study aims to estimate the effect of land use/cover change (LULC) processes on land surface temperature (LST) in Enugu urban and its suburbs.	Landsat images and supervised classification technique.
16	Usman et al., 2023	This paper examined the spatiotemporal variations of Urban Heat Island in Jos metropolis.	Remote sensing and GIS

From Table 3, studies on urban heat islands were carried out using different methodologies; simulation (Adewara & Oyewole, 2019; Adinna et al., 2009; Bassett et al., 2020; Popoola et al., 2022; Umar & Kumar, n.d.), field measurement (Enete et al., 2012) or combination (Popoola et al., 2022; Popoola, et al., 2022).

The selection of the type of methodology to be used largely depends on the aim of the research. Popoola et al., (2022) employed the use of a structured questionnaire to determine the level of awareness of the study population on the effect of urban heat islands while Abur et al., (2018) employed a literature review as a chosen methodology since the research aimed to assess urban heat island mitigation strategies acceptable in cities worldwide and the likelihood of using cooling pavement in Abuja to reduce the impact of urban heat Island.

Table 4 contains the major findings of the reviewed articles and recommendations/conclusions reached by the researchers.

Table 4; shows the main findings of the reviewed articles.

S/n	Authors	Main findings	Conclusion
1	Balogun et al., 2012	On average, the urban/ rural thermal differences are positive, varying from 4°C at nocturnal hours during dry months to approximately 2°C around noon during wet months.	The paper examines urban heat islands (UHIs), focusing on their characteristics, the role of sky view factor (SVF), and the potential impact on energy demand. It explores the link between SVF and the intensity of UHIs, where SVF, the fraction of the sky visible from a point, is a key indicator of the radiative cooling capacity of urban areas.
2	Umar and Kumar, N.D.	Multiple heat islands emerged over the central part of the city and along the major road that linked the city with other states. These areas coincide with the densely build-up area of the metropolis. Likewise, heat island emerges around the international airport of the state.	UHI intensities had a negative relationship with the Normalized Difference Vegetation Index (NDVI), but a positive correlation with built-up.
3	Adinna et al., 2009	Results demonstrate that Land Surface temperature (LST) positively correlate with concentration of urban structures, population density and human activities.	Use of high density green cover, reflective roofing materials, building massing (arcades) and lightening of pavements recommended.
4	Enete et al., 2012	The result indicated that street trees decreased street temperatures by 8 and 5 degree Celsius during rainy and dry seasons respectively. The result also showed that trees like anacarduim, catalpa Bungei, mangifera Indica and azadirachta indica can reduce ambient air temperature to as low as 12 degrees Celsius.	Decreasing temperature using shade trees have other multiplier effects such as lowering evaporative emissions of volatile organic compounds (VOC) from cars, reduction of urban noise, increase property values, decrease stress and aggressive behaviour.
5	Tanko et al., 2017	Urbanisation accounted for 80.5% increment in the LST of Kano Metropolis, thus indicating a very strong positive relationship between urbanisation and UHI.	Afforestation programmes, adoption of green and cool roofing technologies, proper spacing between houses, and accommodation of green areas and open spaces and

			continuous monitoring of weather events.
6	Adeyeri et al., 2017	The trend analysis of LST against different Land use Land cover (LULC) indicated that there is a decreasing trend of LST across the sample points from bare surfaces to water bodies with R of 0.83. Significant hot spots of high LST were recorded in built up areas and bare surfaces while significant cold spots were seen on vegetated surfaces.	In general, the LST, hot spots and cold spots were shown to have been greatly influenced by the LULC of the area
7	Abur et al., 2018	Research efforts these past few years have greatly increased and have revealed that UHI can be mitigated through the adoption of cool pavement technology, also in the area of permeable pavements, and more extensive research is encouraged.	Cool pavement technology could be used to control differential temperature induced by road pavement in Abuja, Nigeria.
8	Chibuike et al., 2018	Study revealed that the mean LSTs inside the green parks (i.e. Millennium Park, Abuja Recreational Park and Zone 6 Neighbourhood Park) were 27.87°C, 29.25°C and 30.66°C respectively.	Consequently, results revealed that urban park size and shape were the most critical factors for mitigating UHI effect
9	Adewara and Oyewole, 2019	The study established that there is a significant change in Land use pattern in area between 2000 and 2018, resulting in a gradual increasing rate in mean land surface temperature, LST (>5% per annum). This change in LULC pattern significantly increased the amount of heat emitted in the metropolis with more than 50C increase (9%).	Proactive steps are needed to control the menace of rapid rise in LST in Ilaro town, which includes afforestation, preservation of water bodies and reduction of the amount of bare surfaces.
10	Esae, 2020	Land-use/land-cover correlates with temperature range in Awka capital territory i.e. temperature correlates with the concentration of urban structures, population density and human activities.	The study suggested use of high-density green cover, reflective roofing materials with high albedo, building massing (arcades) and lightening of pavements.
11	Isioye et al., 2020	LST of Abuja city ranges from approximately 19oC to 39oC with the UHI observed in the northern and eastern parts of the city.	In general, 40% of the city experiences ecologically bad or worse UHI effects, indicating a need for continued UHI mitigation efforts.
12	Bassett et al., 2020	Results indicate that (i) the area influenced by the UHI effect is increasing steeply, (ii) within Lagos's urban outline the UHI intensity (UHII) is increasing, and (iii) rural areas downwind are being warmed by the city.	Results represent Lagos's dry season only and further exploration is needed to map seasonal changes in UHI intensities.
13	Popoola et al., 2022	Between the years 2000 and 2018, built-up area increased by 8.78% at the expense of the non-built up land use. The residents were aware of UHI and climate	The study recommends a community awareness program on the menace of climate change and the

		change but characterized by superficiality.	integration of climate education into the curriculum of schools.
14	Popoola, et al., 2022	Built-up areas increased from 4.1% in 1984 to 20.9% in 2020 bringing significant loss of green land cover. Variations and increased temperature from the thermal reflection of each land use and land cover in Ibeju Lekki, Lagos are also noticeable.	This study, recommends the provision of green infrastructures such as urban tree canopy, parks, open spaces and ecological landscaping to mitigate the surface temperature
15	Ofordu et al., 2022	The results of the surface heat intensity for the urban and rural areas showed a general increase over the years.	Rural experiencing high temperatures which could be due to the loss of vegetation, increase in artificial surfaces and urban encroachment.
16	Usman et al., 2023	The Spatio-temporal changes of LST within the metropolis were on an increase owing to the Rural-Urban migration in the city, due to the presence of commercial and industrial activities within the metropolis.	Need for mitigation of these high temperature.

As can be seen in table 4, possible causes of urban heat island are conversion of green areas to hard surfaces (Adewara and Oyewole, 2019; Ofordu et al., 2022; Popoola et al., 2022; Popoola, et al., 2022; Umar and Kumar, N.D.), deforestation (Adinna et al., 2009; Esae, 2020; Tanko et al., 2017), global warming (Popoola, et al., 2022). Mitigation strategies such as cool pavements (Abur et al., 2018), high-density green cover, reflective roofing materials with a high albedo, building massing (arcades) and lightening of pavements (Esae, 2020; Popoola, et al., 2022; Tanko et al., 2017), afforestation, preservation of water bodies and reduction of the amount of bare surfaces (Adewara & Oyewole, 2019) while Popoola et al., (2022) recommends community awareness program on the menace of climate change and the integration of climate education into the curriculum of schools and other institutions of higher learning.

Conclusion

After the review process, urban heat island mitigation strategies were found to be afforestation programmes, creating/preserving water bodies, reduction in the amount of bare surface, use of high-density green cover, reflective roofing materials with high albedo, building massing, lightening of pavements, use of cool pavement among others.

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BRIDGING TRADITIONS AND ACADEMIA: AN EXPLORATION OF THE POSSIBILITIES FOR COLLABORATION BETWEEN BENIN TRADITIONAL BRONZE CASTERS AND UNIVERSITY-BASED PRACTITIONERS

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Abstract
The art of bronze casting has held a significant and appreciated role in Nigeria's artistic and cultural heritage. One of the visible instances of such cultural heritage is the Kingdom of Benin. The art was shrouded in secrecy and transmitted through hereditary guilds systems in ancient Benin, called the Iguneronmwen (guild of bronze casters). The guiled was formally established during the reign of Oba Oguola in 1280 AD. Despite the massive interruption caused by the British punitive expedition of 1897, the guild was re-established in 1914 and has maintained its centuries-old tradition in bronze casting, even where sociocultural forces have altered. Over the past years, there has been greater- both formal and informal- Interactions between the University of Benin school of art and the local bronze casters in Edo State, Nigeria, which has heralded radical changes in practice and pedagogy of bronze casting practice. This paper thus explores the possible synergy that could exist between the Benin traditional bronze casters and Academics in contemporary learning institutions, such as the University of Benin. It highlights the way innovations involving the utilization of new materials, mechanical aids, and production techniques have been the gain of this collaboration, shortening significantly production cycle, time and expanding creative possibilities. Furthermore, it explains the benefit of this synergy with respect to technological advancement, economic development, and conservation of cultural heritage. The findings propose policy initiatives, create model apprenticeship programs, and craft educational curricula. Outreach programs are how collaborative efforts become formalized and standardized thus, providing greater sustainability to bronze casting in Benin City.

Keywords: Benin bronze casting, Traditional bronze casters guild, Nigerian art, Academic collaboration, Iguneronmwen.

Introduction

The bronze casting is of paramount significance in the Benin people's cultural and artistic legacy. It has a history that stretches to the reign of Oba Oguola, who reigned in 1280 AD (Odiahi, 2017). During his reign, there was a desire to introduce brass casting in Benin, inspired by artworks received from Uhe (Ile-Ife). To achieve this, he requested a skilled brass smith from the Oghene of Uhe, who sent Igue-gha. Known for his exceptional skill and creativity, Igue-gha established foundational designs for future generations. As a result of his contributions, he was later deified and continues to be revered by brass casters. (Egharevba, 1936). This marked the beginning of brass casting in Benin. The artists of the guild (Igun Eronmwon) were given great respect in Benin society because of the commemorative and ritual significance of the items that they created. The bronze casting is not only for aesthetics, however; the plaques and sculptures ordered by the guilds are said to be historical artifacts, narratives that tell the royal victories, society's religion and law (Britannica, 2023). The artifacts, some of which are now referred to as the Benin Bronzes, were produced to decorate the kings' palaces and worked extensively in consolidating the kingdom's identity.

In the late 19th century, the British punitive expedition of 1897 opened up hundreds of irreplaceable artifacts to looting and destruction. This unleashed unimaginable chaos on the tradition of bronze-casting. The guild was revived in 1914 despite this interruption, pushing the efforts to restore and maintain the tradition (Odiahi, 2017). The last several decades have witnessed the art practice being revitalized as fresh artists and schools of learning come together to innovate and keep the bronze casting practice vibrant. This essay therefore deals with the history of bronze casting in Benin, history of the traditional guild system, and existing gains through the interface between indigenous craftsmen and tertiary institutions in Edo state especially the university of Benin school of art. Through this, the essay endeavours to emphasize the importance of preserving this cultural heritage alongside innovations gained through the academic interface.

The Early Periods and the Iguneronmwen Guild

The bronze casting in Nigeria is a very old tradition that is highly embedded in the history of Ife, Igbo-Ukwu, and Benin civilizations. Of the three civilizations, only Benin has continuously practiced bronze casting and hence has made it its continuity and distinctive cultural identity. The earliest recorded history of bronze casting was during the reign of Oba Oguola in 1280 AD, when he invited a bronze master caster from Ife to come and instruct Benin craftsmen in the art of bronze casting.
This encounter therefore resulted in the formation of the Iguneronmwen guild (Plate 1), a hereditary organization that was famed to produce bronze works that glorified the kingdom and its rulers (Odiahi, 2017). The Iguneronmwen guild occupied the rank of the most sacred organization of the kingdom, most likely because it was immortalizing the kingdom's history in bronze for generations to come. The guild members, known as Igun Eronmwon, were extremely renowned in Benin society and created pieces that were ceremonial and commemorative (Odaihi, 2017).

Plate 1: The Entrance to Igun (Bronze Casting) Street, Benin City.
Source: https://www.facebook.com/atqnewsmedia/posts/igun-street-is-a-stone-throw-from-ring-road-roundabout-where-the-benin-national-/2827806384156394/

The British Punitive Expedition of 1897 and Its Ultimate Aftermath

In 1897, the British launched a punitive expedition against the Kingdom of Benin which terminated in the violent invasion and ransacking of Benin City. During this operation, an estimated number of 3,000 to 5,000 irreplaceable artifacts, predominantly comprising bronze and ivory creations of significant historical and cultural value were forcibly removed from the royal palace and its environs (Hicks, 2020; Docherty, 2021). These objects, which include ancestral heads, memorial plagues, and Ritual objects were subsequently commodified in the art market or exhibited in great museums throughout Europe and North America. Such a wide distribution not only separated the artefacts from their cultural and religious setting; but it was also a significant break with the long tradition of bronze casting in Benin.

The systematic destruction of the palace and disbanding of the royal guilds dismantled the institutional and spiritual framework that had supported the casting tradition for centuries (Igbafe, 1979). As a result, the Benin bronze-casting heritage suffered a significant decline, with both production and transmission of knowledge severely hampered.

The Restoration and Continued Functioning of the Guild

In accordance with the previously discussed losses, the Iguneronmwen guild was officially reinstated in 1914 (Odiahi, 2017). That it managed to survive without the traditional patronage of the palace is testimony to the strength of the institution and respect still given to the institution. In recent times, about 1990, the guild has had to face the challenge of new trends and innovations, especially in terms of engagement with practitioners, universities and other institutions of higher learning in Edo state. This association between the universities (such as the University of Benin school of art) and traditional craftsmen has generated seeds of positive change in the bronze casting practice as well as pedagogic practice, i.e. through material exploration, equipment innovation, and production techniques.

Academic and Traditional Bronze Casters' Interaction Dynamics

The 1990s was the decade of a very important phase in the development of bronze casting technology in Benin City. Directly under the supervisory eyes of Mr. Benson Osawe (1931 - 2007), Kenneth and Godwin Eboh, alias the "Skeles" introduced the new and experimental techniques of casting that became an option to the conventional laterite mould investment technique, and other forms of innovations that changed the Benin bronze casting historical narrative. Some of these innovations are summarised as follows:

Investment Mould with Plaster: The traditional bronze casters of Benin employed laterite as one of the old materials for creating moulds. Skeles replaced laterite with plaster of Paris (POP) so that the castings could be made finer and more intricate as depicted in plates 2 – 6.

Plate 2: Invested Moulds in Traditional Laterite Method. Source: https://www.oluwalanu.com/post/bronze-casting-in-benin-a-unique-retrieved, June 11, 2025.

Plate 3: The Traditionally Invested Laterite Moulds. Source: https://www.facebook.com/photo.php?fbid=670962282962547&id=155689984489782&set=a Retrieved, 9/6/2025

Plate 4: Sprue-Wax Work with Core. Source: NJK Studio University of Benin, 2021.

Plate 5: The Researcher Investing with Plaster. Source: NJK Studio University of Benin, 2021.

Plate 6: Completed Investment Ready for Dewaxing. Source: NJK Studio University of Benin, 2021.

Electric Bellows instead of Hand Bellows: Hand bellows were originally used to blow air into the furnace (Plate 7). Skeles substituted the above with electric bellows (Plate 8), which gave a more controlled and constant source of heat and thereby, castings were enhanced in quality.

Plate 7: The Traditional Hand Bellow System. Source: https://www.facebook.com/photo.php?fbid=670962282962547&id=155689984489782&set=a. Retrieved, 9/6/2025.

Plate 8: Electric Bellow in Use. Source: NJK Studio University of Benin 2022.

Piece-mould Casting: This enabled the successful replication of intricate designs in large-scale production with precise detail (Plate 9). Before now, casters used to painstakingly model repeatedly copies of intended concepts one after another. Despite its strenuous presentation, it was time wasteful; but the synergy with university trained casters has brought about the use of piece moulds that enables mass production, as shown below.

Plate 9: Replicated Wax Works Mass Produced from Piece Moulds. Source: https://www.oluwalanu.com/post/bronze-casting-in-benin-a-unique-art. Retrieved June 11, 2025.

These innovations, to which the orthodox guild initially opposed, served as a stimulus to new avenues of collaboration between formal schools of higher learning and local craftsmen. Visibly under the guidance of the late Osawe, the Skeles syncretized these innovations and tradition and thereby rendering both efficient and scholarly productions of higher standards (Plate 10 and 11).

Plate 9: The Improved Casting Through Innovation.
Source: Njk2021, crucifix, Bronze, 9ft × 6ft, Njk Studio, University of Benin.

Plate 10: The Improved Casting Through Innovation.
Source: Njk2023, Crest, Bronze 36" × 36", Njk Studio, University of Benin.

In view of the above, tertiary institutions in Edo state, especially the University of Benin have incorporated better practical methods with emphasis on metal casting into their sculpture and metal design sections. They train students in this regard through assignments, industrial training attachments, workshop, and apprenticeship with veteran professional casters, and this has led to good cross-fertilization of technique, beauty, and pedagogy. Significantly, the University of Benin has been at the forefront in forging synergies by adopting a curriculum that incorporates design thinking principles and traditional craft practice. In addition, the Museum of West African Art (MOWAA) in Benin City has been engaging in partnerships with institutions like the University of Benin aimed at enhancing heritage management and safeguarding traditional practices.

This is funded by provision of access to world-class laboratory facilities and documentary resources, which is being translated into research and development activity in the practice of bronze casting. This collaborative initiative will not only refurbish Benin tradition of bronze casting, but it would

also translate it into a focused area of development and research over time, integrating traditional artisanal expertise and that of the university scholarship.

Prospects for Collaborative Partnerships between Academic and Traditional Bronze Casting Traditions

Technological Advances: Periodic association has enabled the innovation of new equipment and materials and thus improved the efficiency and quality of the casting process. For instance, electric blowers have replaced hand bellows in generating an equivalent source of heat. Plaster moulds have also improved the intensity of achieving designs more intricate than that of laterite moulds (Plates 2 - 8). All these technologies have improved the complexity of the casting procedure and accuracy of the art works to be cast.

Academic Progress: The practice experience provides the students with different experiential learning experiences. The University of Benin is among the institutions of art that have incorporated the metal casting practice in the school curriculum. Students receive apprenticeship and field study with master casters where they can share style, pedagogy, and technique. The experience further enhances their tactility knowledge and appreciation of art.

Economic Empowerment: The cooperative atmosphere has also assisted in creating employment opportunities within the youth of the community and the ability to generate additional opportunities. Bronze casting in Benin is presently a vital economic practice, with foreign and local customers showing interest in business involvement. Moreover, institutions and workshops have provided platforms for the artisans to expose their talents, resulting in increased sales and economic benefits for the locals. The return of Benin Bronzes to local institutions abroad is likely to boost tourism, which will benefit the regional economy in the end.

Artistic Development

The combination of scholarly experimentation and traditional aesthetics has significantly changed the nature of bronze items made in Benin City. New forms and finishing have been introduced through innovative experimentation with modern themes as well as ancient techniques (Plates 11 - 15). This combination has extended the art field and enhanced the reputation of Benin bronze casting; for instance, the traditional artists now achieve and retain sparkling shinny lustre through buffing and lacquer fixative; a practice for finishing jewellery and metals including bronzes in the Metal-Design section of the university of Benin. However, an improved finishing that is scholarly as earlier mentioned in this regard (Plates 13 and 14).

Plate 11: Realistic Bronze Bust Revealing Influence of Interaction Between Traditional Casters and University-Trained Artists. Source: https://rexclarkeadventures.com/igun-street-cultural-heritage-of-benin-bronze-civilization/

Plate 12: The Improved Cast Results.
Isiagbon 2023, Okpanovie, bronze, 36×33", Owina, Benin

Plate 13: An Improved Finishing (Lacquered Bronze) Figure from Igun Street. Source: https://rexclarkeadventures.com/igun-street-cultural-heritage-of-benin-bronze-civilization/

Plate 14: Improved Finishing on Themes in Traditional Benin Bronzes. Source: https://rexclarkeadventures.com/igun-street-cultural-heritage-of-benin-bronze-civilization/

Plate 15: Typical Present Day Igun Street Showing Mixture of Old and New Concepts and Forms.
Source:https://www.facebook.com/photo/?fbid=2827806120823087&set=pcb.2827806384156394.

Enhanced Cultural Interaction

This alliance has made the potential of bronze casting other than in guild restraints and has made greater access to this art and great-scale cultural exchange possible. International interaction and involvement in international exhibitions have made the world at large come and share in the splendid art legacy of Benin. This interaction ensures respect and appreciation of cultures and therefore international appreciation of Benin's art craftsmanship.

Overview and Recommendations

The synergy between the Benin City bronze artists and educational institutions can revitalize and preserve a very rich cultural heritage. To do this optimally, however, the following are recommended:

Establishing apprenticeship framework programs: It is necessary to have extensive training programs involving the guild members and university instructors. The programs can possibly integrate the transfer of traditional knowledge with knowledge of contemporary methodologies with the aim of ensuring the continuation and enhancement of the craft. The Igbo apprenticeship system, being very long in contributing significantly towards the transmission and continuity of artisanal knowledge, can be a good model for such programs.

Public awareness programs: The aura of mystery that pervades the working of bronze and brass needs to be cleared for the general populace and art collectors alike. The statement emphasizes the need for Public Awareness Programs to **demystify the processes involved in bronze and brass casting,** particularly in cultural centers like Benin where such practices have long been enveloped in secrecy, ritual, and technical complexity. This “aura of mystery” stems from the guild-based traditions, sacred customs, and the high level of skill required - factors that often make the art seem mystical or esoteric to outsiders. Clearing this mystery is essential to making the art form more accessible and understandable, not only to the general populace but also to art collectors, curators, and enthusiasts’ appreciation of the historical, cultural, and technical dimensions of bronze and brass artwork can enhance wider awareness and informed interest. Finally, the call is for well-designed educational initiatives in the range of exhibitions, public lectures, studio tours, workshops, and documentaries, that illuminate the art form's significance and relevance. In creating receptiveness and sensitivity, such activity would ensure preservation of the tradition while establishing its value in contemporary cultural and artistic discourse. More education can enable a

greater appreciation of the cultural heritage of bronze and brass and the technologies that go into their creation. The establishment of the Museum of West African Art (MOWAA) in Benin City, with modern research and conservation technologies, is a big leap towards raising public awareness and sensitivity towards these cultural objects.

Policy Support: The governmental institutions and cultural organizations need to offer financial assistance in terms of grants and workshops to encourage collaborative artistic endeavours. Institutional support from bodies like the Nigerian Export Promotion Council and the National Museum and Monument would go a long way to improve market access and international visibility for Benin bronze casting**.**

Mutual understanding and respect: This leads to constructive dialogue that encourages mutual respect between academic and traditional stakeholders. These can involve the exchange of views and the provision of an open forum for preservation and development. The use of participatory strategic planning allows for the preservation of the Benin bronze casting art that has been in existence for centuries while at the same time developing to address contemporary aesthetic and economic needs.

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Appendix A: Fieldwork Interviews and Visits

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DEVELOPING A FRAMEWORK FOR IMPLEMENTING HEALTH AND SAFETY MEASURES IN SMALL AND MEDIUM-SIZED OIL AND GAS CONSTRUCTION PROJECTS USING PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING (PLS-SEM)

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Abstract
The oil and gas industry plays a pivotal role in Nigeria's economy, serving as a major driver of the nation's economic growth and development. It is one of the largest contributors to Nigeria's GNP, which emanates from the revenues generated through the exploration, production, and exportation of petroleum and natural gas. However, despite its economic importance, the industry still grapples with persistent issues regarding poor Health and Safety (H&S) performance. As a result, there has been increased need for adopting H&S measures that could help improve the situation. Therefore, this paper is aimed at developing a framework for implementation of health and safety measures for small and medium sized oil and gas construction projects in Nigeria with a view to improving the safety performance of the oil and gas companies using Partial Least Squares-Structural Equation Modelling (PLS-SEM). The findings revealed that, use of First aid kits with MIS of 4.28 is the most effective safety practice required on construction sites. It was also found that low level of compliance with occupational H&S regulations with MIS of 4.21 is the most severe challenge affecting the implementation of health and safety measures for SMEs oil and gas companies. Cost of workmen's compensation with the MIS of 3.79 is the most significant effect of implementation of health and safety measures on the cost of accidents. While H&S provision in condition of contract with MIS of 4.15 was ranked as the averagely implemented regulations for enhancing effectiveness of health and safety measures. This study concludes that use of first aid kits, use of Personal Protective Equipment (PPE), safety policy, safety personnel, health and safety risk assessment, health and safety training, good working environment, welfare facilities, and safety inductions are the effective safety measures required on construction sites by small and medium sized oil and gas construction projects.

Keywords: Model, Oil and Gas Construction Projects, PLS -SEM, Health and Safety Measures, SMEs.

Introduction

The health and safety (H&S) performance in the oil and gas industry remains a glaring challenge in its effort to tackle the developmental initiative of many nations including Nigeria, as a result, accidents not only result in considerable pain and suffering but also retard project productivity, quality, and time and consequently contribute to higher costs in the sector [7, 22]. However, cost implication of Health and safety prior to tendering and during execution are rarely considered during budget and often not discussed in site meetings by the relevant stakeholders for the Nigerian small and medium sized oil and gas companies. [1, 10]. Health and safety has been a significant concern for employees, employers, and governments worldwide for decades, prompting the Nigerian government to regulate the oil and gas industry in an effort to reduce occupational injuries and fatalities [11]. Soomro *et al.* [3] opined that Nigeria is among the countries having no adaptive Health and safety measures and regulations where small and medium sized oil and gas companies allocate little or no resources [17, 8] to H&S management. Benneth *et al.* [24] buttressed that, poor health and safety management in SMEs often results from a combination of interrelated factors, most of which revolve around the necessity for compliance with the legal framework. Bensonch *et al*. [1] revealed that, compliance with rules and regulations provides the foundation for workplace safety practices, its effectiveness relies considerably on how such measures are enforced by the relevant government authorities. The constrained capacity of SMEs to manage health and safety is usually related to a limited financial and human resources capacity, whereby most SMEs are characterized by tight budgets that limit their ability to invest in comprehensive safety measures or employ specialized personnel to oversee compliance [19, 21].

This economic limitation can lead to superficial or partial adherence to regulations, undermining the intended outcomes of workplace safety policies. In addition, the role of government bodies in effective enforcement is very important and poor monitoring and inconsistent enforcement, along with a lack of support mechanisms for SMEs, can lead to poor compliance [23]. For instance, insufficient inspection frequencies or leniency in penalizing violations may reduce the perceived importance of adhering to health and safety standards. Moreover, various barriers to accessible guidance or training programs provided by regulatory authorities may put SMEs in a position where they cannot gain the knowledge or competencies to implement safety protocols effectively. [16, 9]. Additionally, regulatory complexity may pose significant challenges, especially for small companies or those lacking a dedicated compliance team. These organizations often struggle to implement intricate legal requirements, which can lead to unintended non-compliance, particularly in sectors where health and safety risks are complex and require sector-specific solutions [1,7]. Hence, there is the role of cultural and organizational factors, which hold salience in the SME world such as, owners and managers of small enterprises might prefer short-term business needs to long-term investments in safety, considering regulatory compliance a bureaucratic burden rather than a strategic necessity [2, 18]. This mindset, combined with or circumscribing weak enforcement, tends to maintain a reactive instead of proactive approach to health and safety management.

The regulations of Health and Safety Environment (HSE) in Nigeria have received little attention, with little emphasis to strict adherence to health safety in the oil and gas industry and very minimal impact made by the inspection officers towards ensuring strict compliance [5]. The situation is quite tragic due to lack of existing functional legislation to that effect and there is no reliable data on accident cases in the oil and gas industry in Nigeria, because companies do not report accidents to appropriate ministry nor keep proper records on accidents. Occupational health and safety regulatory system in the country does not encourage mandatory reporting of accidents [15]. Recent data revealed that, within the petroleum industry of Nigeria, an estimated Oil 412 deaths had been recorded between 2018 and 2022 alone, due to negligence in the storage and distribution value chain. In a single year-from September 2021 to September 2022, the sector recorded 60 deaths and 62 injuries due to 34 incidents [6]. These statistics have shown the critical need for improvement in H&S measures within Nigeria's oil and gas industry and hence the need to address these challenges cannot be overemphasized if the nation is to protect the workforce and ensure the sustainable

development of the sector. In the final analysis, the effectiveness of efforts towards health and safety management in the SMEs is largely prejudiced by implementation practices of government bodies, there being a need for compliance with the existing rules and regulations. Improvement in the mechanisms of enforcement, simplification of the compliance processes, and providing targeted support for the same is considered critical in fighting the manifold factors that lie underneath poor health and safety management in these enterprises [12, 9]. Hence, there is need to find a way of minimizing the rate of falls and injuries in Nigerian oil and gas industry. Osuoka and Asume [23] develop a framework for public participation in safety culture in the Nigeria extractive industries. Waqar *et al.* [37] conducted a similar study in Malaysia to develop a conceptual framework for safety measures in downstream oil and gas construction projects. A quantitative study, which consisted of a pilot survey and a main survey involving individuals who perform these types of researches, therefore employing exploratory factor analysis (EFA) for pilot survey data and structural equation modeling (SEM) for main survey data, safety factors recognised as critical included poor safety maintenance conducted to training of workers, insufficient safety procedures and inadequacies supervision. The results offer an understanding of the important safety factors in Malaysian oil and gas industry and can help in improving both theoretical and practical aspects of safety in the sector. This research helps to fill a gap in knowledge regarding construction safety in Malaysian oil and gas sector by highlighting the most important contributors to accidents in this industry. Numerous health and safety performance improvement models have been developed in recent years. For instance, Buerkle *et al*. [13] developed a model to measure the effectiveness of Health and safety management in the extractive construction sites. The model was based on 3P +1 namely policy, process, personnel and incentive factors. These core factors were measured by 590 attributes. The large number of attributes might not be practical in the context of SMEs because they did not show the interrelationship of the factors in reducing accidents on site The model was validated using large contractors in Thailand. It might be possible to test this model or a modified model within SMEs. This is because SMEs and large organisations are different in terms of their characteristics. Large organisations are more properly resourced and organized than SMEs. Summarily, there exist limited studies on a model for effective implementation of health and safety measures for small and medium sized oil and gas companies in Nigeria as the existing ones are too generic and are particular to foreign and multi–national construction firms which are characterized with shortcomings of not capturing the peculiarities of Nigeria. Itaman *et al*. [20], Pilbeam and Colin [12] revealed that, safety practices lack necessary framework for the implementation of health and safety measures in the oil and gas industry with particular emphasis to the small and medium sized companies and thus leading to increase in accidents on construction sites and cost of compensation to injured workers. This brings about ineffective cost performance of projects. It is against this backdrop that this research focuses on the development of model for implementation of health and safety measures for Small and Medium Sized oil and gas companies in Nigeria.

Conceptual model for the implementation of health and safety measures for Small and Medium Sized oil and gas companies

According to Crovini *et al.* [9], concept is a plan, vision, or a symbolic representation of an abstract idea, while conceptual model in research shows the researchers' position on the research problem, which gives direction to the study, and further shows the relationships that exist between different constructs that the study intends to investigate. It may be an adoption of a model used in a previous study with modifications to suit the present investigation. Thus, it is referred to as, an organisation, or matrix of concepts that provide a focus for enquiry. The conceptual model, therefore, gives direction and rationale for undertaking the subsequent stage (methodology) of this research process [14]. This section focuses on the development of a model based on the literature review of H&S measures implementation. From the review it was identified that implementation of health and safety measures may lead to accident prevention which have economic impact on contractors, it is necessary to have a conceptual model that brings together these key parameters to be investigated to aid the data collection phase of the study.

In the literature review, it was argued that implementation of safety measures could offer decision support tools for health and safety management in the construction industry thereby widening safety measures implementation efforts. This section consolidates that argument by putting forward a model that establishes the benefits of accident prevention and integrates these elements to highlight the potential economic case for accident prevention. A logical progression of this argument is that the greater the investment in health and safety measures, the greater the reduction in accident and improvement in performance through first aid, PPE, safety training, safety promotion and safety personnel, during project delivery this translates into greater accident costs. A significant challenge for contractors is to reduce accidents by taking effective action or measures to reduce the risks of accidents and ill health [12, 37]. The extractive site safety implementation model to be developed in this research would depend on the understanding of good safety measures which can be achieved through management commitment, and it is the first safety best practice identified, and one which will be essential to any good safety program.

The second part is about the implementation of safety policy, H&S Regulations, safety rules, safety organization chart, assigning of safety responsibilities to personnel on site, compliance of safety rules with legislation, safe working environment, safety induction and performance monitoring for subcontractors on site and selection of subcontractors based on safety policy. The third part consists of safety training of contractor's workers on site. The training includes induction training of persons at site, providing updated safety information to all the workers on site and to promote safety on construction site by displaying proper sign boards and by introducing different award schemes on site. At this level the H&S critical positions must have been identified in other to build a background to customize the firm's policy. The next stage is to identify the challenges to effective implementation of H&S measures and its effect on the safety performance. Emergency response procedures, which are plans for handling emergencies that may occur on the construction site, including, but not limited to, injuries resulting from falls, fires, explosions and releases of hazardous materials including investigation including accident recording and analysis should be an integral part of the safety strategies for enhancing safety performance which should be on continuous basis. The last part is about the safety review to evaluate safety features of completed projects and to identify any site conditions that may negatively affect safety in an effort to implement the necessary changes to improve safety of the ongoing project and for the future projects of the company. Safety review may include safety hazard review, site safety policy review and the safety audit for the construction site.

Method of Data Analysis

The target population for this study constitutes the number of registered construction firms of small and medium sized medium size categories (ISO certified) with Corporate Affairs Commission (CAC), Nigerian Upstream Petroleum Regulatory Commission (NUPRC) and the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) for midstream and downstream operations. The respondents include the owners or managers, professional members and non-professionals, HSE personnel who are staff of the oil and gas industry. A list of 3,000 oil and gas SMEs companies was obtained from the most recent directory of the Corporate Affairs Commission of Nigeria after series of visit. The research design used for the study was descriptive sample survey, whereby the questionnaire been the main instrument for the study was administered to the contractors and consultants of the companies and the results were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM).

The survey strategy uses a "closed ended" type of questionnaire for this study. Questionnaire were self-administered to the respondents, by the researcher. The questionnaire was divided into sections. Section a required information on respondent's background. While the other sections were for more specific questions which raises response on the implementation of health and safety measures required in the oil and gas activities, challenges affecting the implementation of safety measures by oil and gas SMEs and the strategies for improving the level of implementation of safety measures by oil and gas SMEs. The respondents were asked to rank the various sections using a 5-point scale. The frequency of occurrence included: 1= least effect, 2=Low effect, 3= Moderately low

effect, 4= High effect and 5= Very high effect (for likelihood of effect of safety measure on rate of accidents occurrence) and 1= Not implemented, 2= Partially implemented, 3= Fairly implemented, 4= Averagely implemented and 5= Completely implemented. Effective safety measures required on oil and gas site occurrence and a multiple response for the other sections. In order to analyze the data got, the researcher used the Partial Least Square Structural Equation Modeling (PLS-SEM).

Structural Equation Model

Structural Equation Model (SEM) is a statistical model that seeks to explain the relationships among multiple variables. The two types include: Variance-based PLS (VBPLS) and Covariance-based PLS (CBPLS). VBPLS

Advantage over CBPLS is that:

I. It has the ability to accommodate constructs measured by a large number of variables;
II. It allows for greater complexity within the model and can be used with non-parametric data;
III. Sample size requirements are not as robust and dependent on power analysis for a determination of an appropriate sample size;
IV. It attempts to maximize variance explained in the latent variables through the relationship with the independent variables.

Structural Equation Model (SEM) is a method for estimating, representing and testing a theoretical network of mostly linear relations between observed and construct variables. It is more comprehensive and adjustable than any other path (such as multiple regression, correlation and ANOVA), providing means of governing not only for extraneous variables, but also for measurement errors as well [36].

SEM is said to be a second-generation multivariate data analysis (MDA) incorporating certain aspects of factor analysis and regression analysis in a bid to evaluate the relationship between defined measurement variables and predetermined constructs [29]. Recent use of this method in the development and testing of hypotheses has become common in most social science research [26]. As stated by Alzahrani *et al.* [35], in most researches, the key reason for using this method is its ability to test simultaneously series of interrelated dependency relationships that occur in various sets of constructs, calculated by multiple variables and at the same time account for measurement error.

For questionnaire-based research, each indicator represents a particular question. Latent variables (or construct, concept, factor). Latent variables are normally drawn as circles. Latent variables are used to represent phenomena that cannot be measured directly [30]. Path relationships (correlational, one-way paths, or two-way paths). These relationships are defined using arrows. Davies *et al* [27] revealed that, in structural equation modeling (SEM), exogenous constructs are latent variables that act as independent variables in the model. They are considered the starting points or sources of influence in the model due to the fact that, it does not possess any other variables gearing to it, which means does not possess any predecessors. This depicts that, exogenous constructs are not influenced by other variables within the model; instead, they influence or cause changes in other variables. In such a way, these constructs are the initial factors that drive the relationships in the model, and it represent causes rather than effects. For example, in a model exploring the impact of work environment on job satisfaction, the work environment might be an exogenous construct, influencing other variables like job motivation or job satisfaction, but it itself is not influenced by any other constructs in the model.

SEM is said to be a second-generation Multivariate Data Analysis (MDA) incorporating certain aspects of factor analysis and regression analysis in a bid to evaluate the relationship between defined measurement variables and predetermined constructs [8, 31]. Recent use of this method in the development and testing of hypotheses has become common in most social science research. As stated by Paraschi *et al.* [32], in most researches, the key reason for using this method is its ability

to test simultaneously series of interrelated dependency relationships that occur in various sets of constructs, calculated by multiple variables and at the same time account for measurement error.

According to Trail *et al*. [38] there are three types of SEM (CB-SEM, PLS-SEM and GSCA) with the two most common being CB-SEM and PLS-SEM. This research used PLS-SEM, specifically Smart PLS Version 3.3.2 and SPSS V 23 S to determine the hypothesized relationship between the constructs. Study of Wang *et al.* [42] buttressed that, PLS-SEM is the most popular SEM technique in various fields that has gained considerable attention. Its use is mainly evident in numerous fields, including; business marketing, e-business, organizational management, international management, and human resource management, where it helps to analyze complex relationships, optimize decision-making, and enhance overall performance through data-driven insights. In extractive-related studies, PLS-SEM has equally gained significant recognition. According to Ciavolino *et al.* [43], besides the benefit of PLS-SEM is it has higher statistical power which is best to use in the exploratory study. Initially, a preliminary analysis was carried out to confirm the fitness of data for PLS-SEM modelling. Secondly, PLS-SEM validity of measurement and structural model along with hypotheses test were carried out. In such case, the measurement model fixes the relationship between constructs and attributes while the structural model determines the relationship between constructs and unobserved variables. Lastly, the evaluation matrix was carried out to identify the real condition of all categories of construction in terms of safety performance

Assessment of PLS-SEM

PLS-SEM is assessed using the coefficient of determination (R2) of each of the latent constructs. Coefficient of determination (R2) is used to describe the overall goodness of fit of an estimated model of one or more independent variables. A value of zero means perfect fit, while a value < 0.08 is considered good fit [41]. However, some authors accept values ≤ 0.10 [39].

Coefficient of determination (R^2)

Coefficient of determination (R^2) measures the relationship of a constructs explained variance to its total variance, at this stage each dependent construct is assessed. It is suggested that R^2 for endogenous constructs should be greater than 0.1 [43]. However, interpreting R^2 value is based on research discipline, in general the R^2 values considered are 0.75, 0.50 or 0.25 and endogenous constructs can be described as substantial prediction, moderate prediction and weak prediction, respectively [29, 41]. On the other hand, Trail *et al*. [38] establish that, in social sciences, R^2 values from 0.04 to 0.16 can be described as moderately weak and from 0.25 to 0.49 are considered moderately strong. Considering this criteria, PLS-SEM algorithm gave weak values for H&S measures 0.077 (7.7%) and strategies for improving implementation of safety measures 0.160 (16%). While a moderately strong value was gotten for cost of accident 0.282 (28.2%) and improved safety performance 0.834 (83.4%). In addition, they all complied with Liengaard and Dybro [41] rule by being above 0.1. However, the improved safety performance construct was considered the strongest, explaining 83.3% of the variance. Figure 1 shows the structural model with path coefficients and R^2 and structural model with t-values respectively with respect to the discussions.

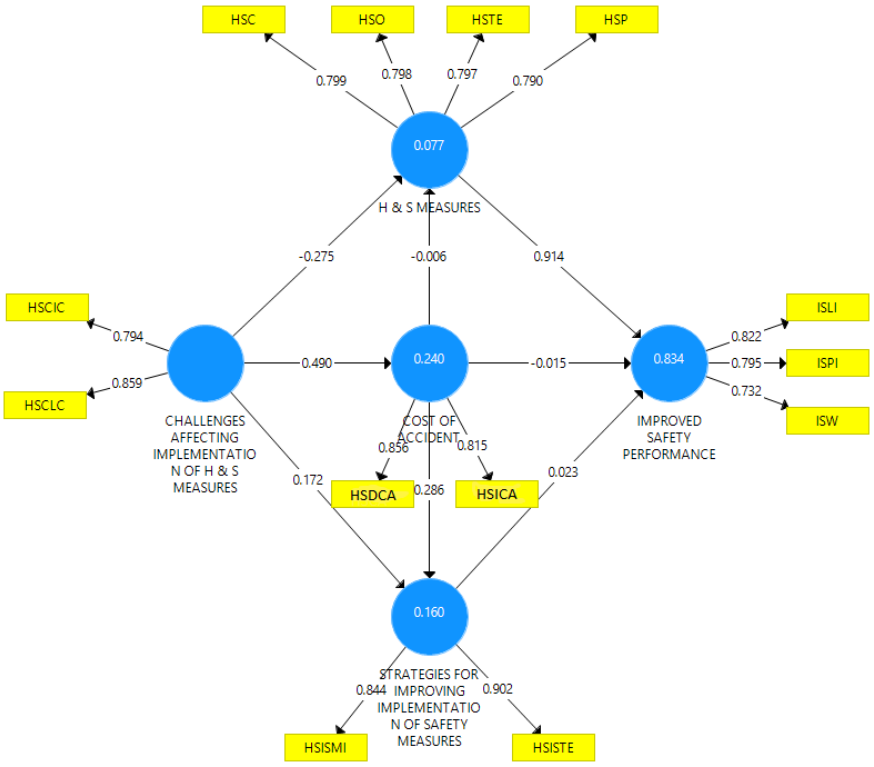

Figure 1: Structural Model with Path Coefficients and R^2

Discussion of findings from the Model Result

PLS-SEM was used to test both the direct and indirect relationships among all the constructs. The predictive power was analysed using R^2 as shown in figure 5.42. A moderately strong predictive value was gotten for cost of accident 0.282 (28.2%) and safety performance 0.834 (83.4%). In addition, all researchers complied with Capeda *et al.* [40] rule by being above 0.1. However, safety performance construct was considered the strongest, explaining 83.3% of the variance. Furthermore, the structural model path coefficients determined from the t-value, and significance level (p-value) for all hypothesized relationships in the model indicates that maximum six (6) of the paths (H1, H2, H3, H4, H8 and H9) were strongly significant and only three (3) paths (H5, H6 and H7) did not meet the required value of the rule of thumb.

Considering the effect size of the model, it was deduced that H&S Measures to safety performance (H8) had a large effect size with f^2 value of 4.889. Challenges affecting implementation of safety measures to cost of accident (H2) had f^2 value of 0.316 was said to have medium effect on the model. While challenges affecting implementation of safety measures to strategies for improving implementation of safety measures (H1) had f^2 value of 0.027, challenges affecting implementation of safety measures to H&S Measures (H3) had a F2 value of 0.062 and cost of accidents to strategies (H4) had a f^2 of 0.074 which were said to be having small effect on the model. In addition, cost of accident to H&S measures(H5) had f^2 value of 0.000, strategies to safety performance (H6) had f2 value of 0.003 and cost of accident to safety performance (H7) had a f2 value of 0.001 were indicated to have no effect on the model.

Looking at the predictive relevance of the constructs in the model it was indicated that, strategies for improving implementation of safety measures and H & S measures had Q^2value 0.111 and 0.047 respectively had a small predictive relevance. Cost of accident with Q2value was found to have medium predictive relevance on the model, while safety performance with Q^2value of 0.504 had a large predictive relevance in the model fitness, therefore, the model can be said to have a good predictive value.

The SRMR value of 0.10 was obtained and this was considered accepted meaning that the model has a good fitness.

Conclusion

Upon conducting an extensive review and analysis, this study arrives at the following conclusions: This study concludes that use of first aid kits, use of Personal Protective Equipment (PPE), safety policy, safety personnel, health and safety risk assessment, health and safety training, good working environment, welfare facilities, and safety inductions are the effective safety measures required on construction sites by small and medium sized construction firms. This study also concludes that the challenges affecting the implementation of safety measures by Small and Medium Sized oil and gas companies are low level of compliance with occupational health and safety regulations, management commitment, lack of adequate information on occupational health and safety (OHS), weak national occupational health and safety (OHS) standards, and weak legal structures. On the effect of implementation of safety measures on the cost of accidents, this study concludes that; disruption of site activities, personal injury claims, cost of workmen's compensation, time lost due to absence from work, loss of confidence and reputation, reduction in productivity, and strained management-labour relationship are the effect of implementation of safety measures on cost of accidents. This study also concludes that provision of personal protective equipment, communication of H&S policy and programs to staff, use of building codes of practice, collective protective equipment such as scaffolding, safety nets fencing and accessibility, provide first aid supplies, deal with any hazards promptly, training and enforcement, risk awareness, management and tolerance, and safety inspection are the effective strategies used for improving the level of implementation of health and safety measures in the oil and gas industry by Small and Medium Sized oil and gas companies.

The conceptual model was validated through findings derived from PLS-SEM conducted using Smart PLS 3.3.2. The analysis of the SEM revealed that there was no positive statistically significant relationship between Cost of accident and H&S measures, Strategies for improving implementation of safety measures and Improved safety performance, Cost of accident and Improved safety performance. The SEM analysis also revealed that positive statistical significant relationship exists between Challenges affecting implementation of H&S measures and Strategies for improving implementation of safety measures, Challenges affecting implementation of H&S measures and Cost of accident, challenges affecting implementation of H&S Measures and H&S measures, Cost of accident and Strategies for improving implementation of safety measures, H&S Measures and Improved safety performance and finally, the analysis also revealed that the indirect relationship between challenges affecting implementation of H&S measures and Improved safety performance was also significant. As a result of these, the study concluded that the constructs that constitute the strategies for improving the implementation of health and safety measures are: training and enforcement, awareness and advocacy, safety programs and monitoring and inspection, and all these constructs showed positive significant effects on improved safety performance. The research therefore concluded that the SMEs in Nigeria can adopt the developed model to ensure effective implementation of health and safety measures to enhance safety performance in the oil and gas industry.

Recommendations

To ensure effective implementation of health and safety measures for SMEs in the Nigerian oil and gas industry, the following recommendations are drawn from the conclusions of the study:

I. SMEs should encourage and enhance the implementation of first aid kits, Personal Protective Equipment (PPE) and safety policy as they have been identified as the effective health and safety measures required in oil and gas activities to further reduce accidents and unnecessary expenses that may amount as result of accident.
II. Since it has been identified that; low level of compliance with occupational health and safety regulations, management commitment, lack of adequate information on occupational health and safety (OHS), weak national occupational health and safety (OHS) standards, and weak legal structures are the major challenges affecting the implementation of health and safety

measures by SMEs. This study recommends that companies should have a more stringent in-house rules by incorporating the 'carrot and stick' approach (that is, a combination of reward and punishment) to induce good behaviour. In addition, reduction in cost of safety training, adoption of seminars and workshops to engage SMEs to be part of OHS activities, and ensuring the right safety culture for professionals and site workers is crucial for the advancement of OHS and for the wellbeing of the workers.

III. Disruption of site activities, personal injury claims, cost of workmen's compensation, time lost due to absence from work, loss of confidence and reputation, reduction in productivity, and strained management-labour relationship have been identified to be the effect of implementation of safety measures on the cost of accidents, therefore, this study recommends that, though construction professionals think profit will decrease and safety cost will increase when safety measures are implemented on construction projects. However, investment in health and safety measures will increase profitability by increasing productivity and uplifting employee confidence.

IV. This research recommend that companies should ensure provision of adequate personal protective equipment, communication of H&S policy and programs to staff, encourage the use of building codes of practice, provide collective protective equipment such as scaffolding, safety nets fencing and accessibility, provide first aid supplies, deal with any hazards promptly, training and enforcement risk awareness, management and tolerance, and conduct safety inspections at predetermined intervals so as to improve the level of implementation of health and safety measure on SMEs companies.

V. Organizations and oil and gas stakeholders should encourage, ensure, and promote the proper implementation and adoption of the developed and validated model for health and safety measure implementation as it is intended to support SMEs companies as well as professionals in identifying safety issues, putting measures in place to curb challenges inhibiting safety measures implementation and improving on the safety practices in the SMEs companies in order to enhance efficient productivity, competitive advantage and boost performance.

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LIFE CYCLE COST ANALYSIS BETWEEN A DOUBLE GLAZED AND A TRIPLE GLAZED WINDOW TO A PROPOSED STUDENT HOUSE IN A SUB-TROPICAL ENVIRONMENT

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Abstract
Windows typically occupy about 15 to 20 percent of the surface area of outer part of building walls. Windows not only add to the aesthetics, they are often a very important aspect of a building; and also, a very significant component of building heating and cooling costs. Windows lose more heat per square meter of area in cold season and gain more heat in summer days than any other surface in the building if not they are energy efficient. When it comes to fitting new windows, there are lots of things to consider. One of the main debates is whether to choose double glaze or triple glazed window in temperate or sub-tropical climates. Homes can lose up to 25% - 30% of energy through the windows alone, however a double layer of glass or triple layered glass window will have prevented much of the energy from escaping the interior spaces of house. Heat retention can save you money on your electricity bills in the long run and means you are running a more environmentally friendly home, as you are wasting less heat and using less energy which will pay back in the long run. This paper takes a case study for this experiment which is setup for a proposed student house for Eastern Mediterranean University located in Famagusta, North Cyprus. The house is 350 meters square with openings on each side. The price of a double or triple glazed window will depend on its quality, in terms of window frames. Aluminum and composite window frames are usually cheaper than timber-framed windows.

Keywords: Double Glazed Window, Triple Glazed Window, Energy efficiency, Cost calculation, Life cycle Analysis

Introduction

In sub-tropical climate region, an average home loses up to 25% - 30% of its heating and cooling energy through its windows and doors. If you have inefficient windows installed in your building, you also have rising energy costs because of the energy that you will use for the heating and cooling of the house. An energy efficient home is a comfortable home, as it is one that is easier to heat or cool. Making sure your home is energy efficient will not only improve comfort but will also save money on energy consumption. Insulation, location, and the materials used in home construction will all help to increase energy efficiency. The window type you use in your home is also critical when it comes to energy efficiency. If you are deciding between single glazed and double glazed windows, it's important to know the differences, and which option is better for your home efficiency.

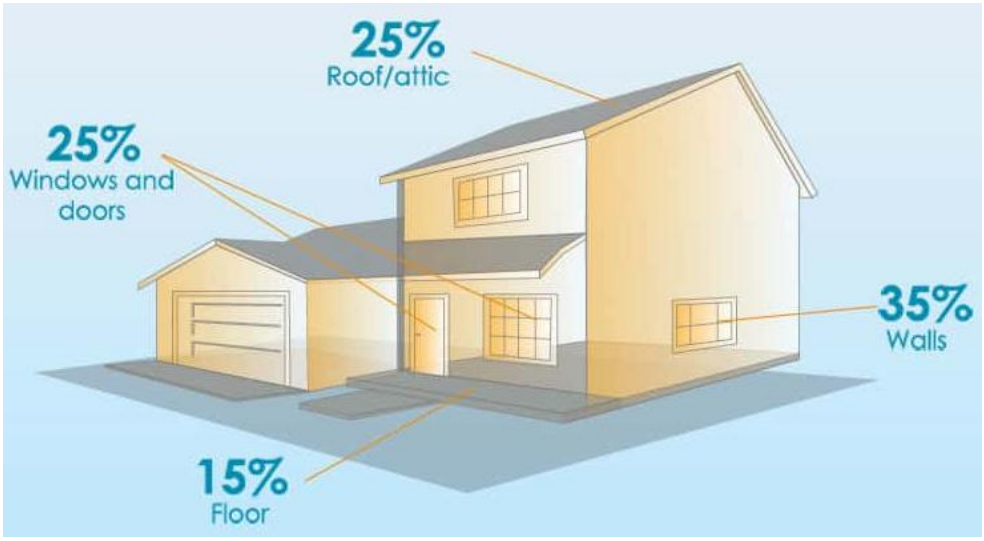


Figure 1: Mapping out home heat lose through the building envelope
Source: https://www.greenhomegnome.com/wp-content/uploads/2013/08/energy-loss-insulation-infographic-cover.jpg

By installing energy efficient window or upgrading your older windows to energy-efficient windows with Low-E coatings, you can lower your energy bills up to 15% to 20% a year, according to the Efficient Windows Collaborative, a coalition of government agencies, research organizations, and manufacturers that promote efficient window technology. A recent study by Energy Star (2023) revealed that by switching out your single glazes or even your newer double glazed, clear-glass windows to energy-efficient windows, you can easily achieve a very good energy efficient comfortable home that can save a lot and payback in long run by the energy bills.

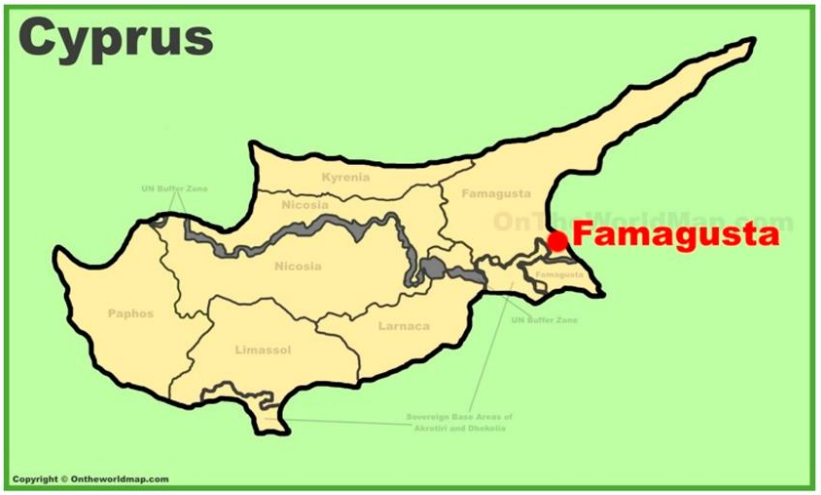


Figure 2: Map of North Cyprus Showing Famagusta.
Source: https://www.researchgate.net/publication/Location-of-Famagusta-city-in-Cyprus.tif

Methodology

This research focuses on the following two questions:

1. The energetic performance of window types: does double glazed or triple glazed window reduce required heating and cooling energy
2. Life Cycle Cost analysis of the two types: is it financially beneficial and feasible to invest in triple glazed or double glazed window

The energetic performance is measured using computer analysis software (Energy Plus), which also gives us our usage cost. Using life cycle analysis data, a comparison is made concerning the environmental costs of the product itself, and a quick cost comparison shows the financial benefits and drawbacks between the two products and the payback period of the two different window types.

Double Glazed Window

Double-glazed windows have two panes of glass fitted into a window frame. An inert gas such as argon is filled between the two panes in order to increase insulation. Double glazed glass is perfect for weather conditions, especially where there are scorching summers and moderate winters. The double windowpanes not only provide relief from extreme temperatures outside, but also insulate your space from the noise outside. They are also very hard to break through and therefore provide you with ample security against intruders.

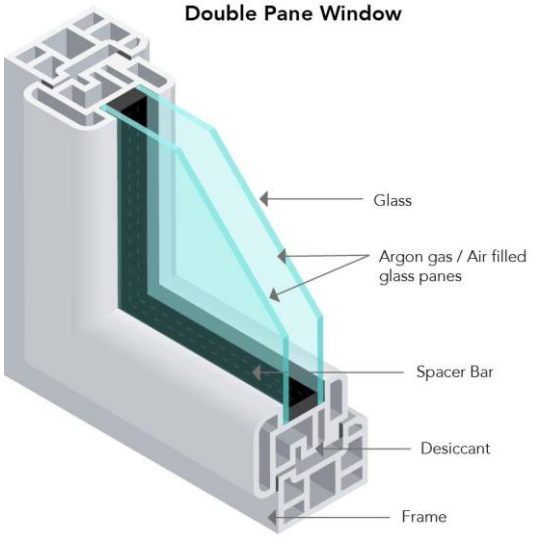


Figure 3: double glaze window property
Source: https://www.efficientwindows.org/img/glazing_single.jpg

Double glazed windows utilize two separate pieces of glass, separated by a vacuum. The vacuum layer acts as an insulation barrier. The glass used can be laminated or UV tinted but is otherwise similar to the glass used in single glazed windows. When double glazing is retrofitted to an existing window installation, the thermal efficiency can be improved by up to 80%. Factory made double glazed windows can be up to 100% more efficient than a single glazed alternative.

How a Double Glazed Window Works?

A single pane of glass provides very poor insulation because glass is a good conductor of heat. So much of the heat in your room literally goes out through the window. It is therefore advisable to install double glazing with a layer of air or argon gas trapped between two panes of glass. Because air or argon gas is a poor conductor of heat, much less heat is lost through such a window. If the inside of one sheet has Low E coating, even less heat is lost, because the coating reflects heat back into the room. A house with double glazed window operates just like fiberglass batts and woolen clothing. It traps a layer of air or argon gas between two panes. Air or argon gas is a very poor conductor of heat, so the trapped layer sets up a blanket of protection between cold air on one side and warm on the other. Glass itself is a very good conductor. So in a sub-tropical home without

double glazed window, heat is going straight out of the window. As shown in the figure 3. Argon gas is an inter gas.

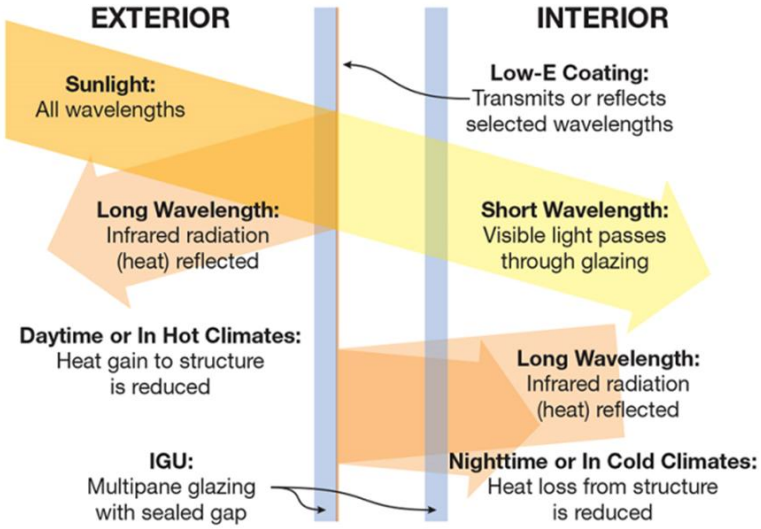


Figure 4: how double Glazed window works
Source: https://www.efficientwindows.org/img/glazing_single.jpg

What Benefits Does Double Glazing Provide?

The most obvious benefit to be gained from double glazed windows, is the increase in energy efficiency. This means that it will be easier to maintain the temperature inside your home. This is especially beneficial to families with air conditioners, or central climate control systems.

An example would be a home that is using a split type of air conditioner/heat pump to warm a living room during winter. Without double glazing, the warmth inside is easily lost. This means that the indoor unit is forced to work harder to maintain a comfortable temperature in the room.

With double glazing, heat loss can be reduced by half in optimal conditions. When combined with insulated curtains covering the windows, the heat loss becomes even less.

I. The biggest attraction of double glazing is its capacity for insulation and heat retention. The layer of insulative air trapped between the two panes helps reduce heat loss, acting as a barrier that keeps in the warm air.
II. Double glazing can save you money on your energy bills due to the increase in the thermal efficiency of your home. Less energy output is needed to heat up your home, resulting in lower bills.
III. Condensation is limited in homes with double glazing. The insulative layer of gas or air between the panes prevents condensation by inhibiting the build-up of moisture caused by cold weather. This effect is enhanced by the effective seals found on double glazed windows.
IV. If you live on a noisy street upgrading to double glazing can be a godsend. The added thickness works wonders at noise reduction, helping to block out the sound of traffic and roadworks from outside.
V. Safety is improved with double glazed windows, as they are tougher than their single glazed counterparts. This makes it more difficult for would-be criminals to break into your home.

Triple Glazed Windows

Triple-glazed windows, as the name suggests, have three panes of glass fitted into a frame. The three sheets of glass have two air gaps filled with argon.

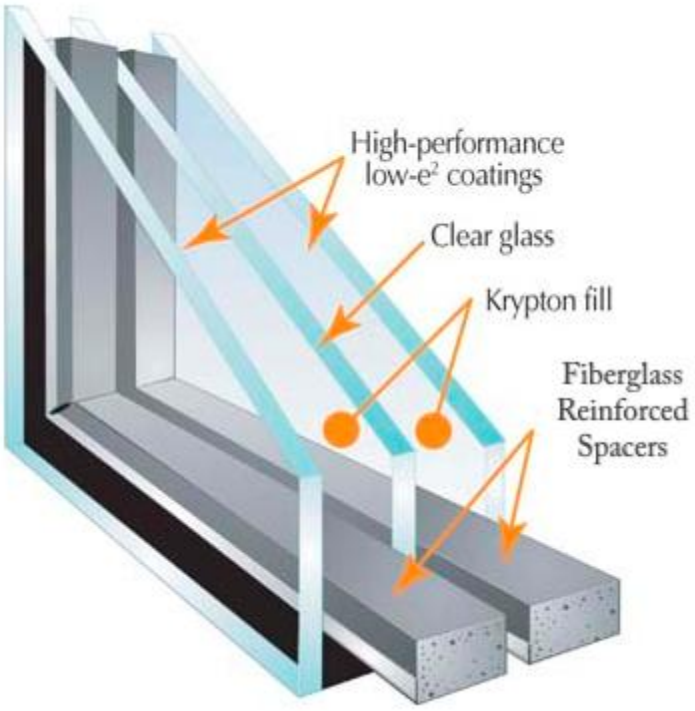


Figure 5: Triple glazed window
Source: http://www.newquayplastics.biz/wp-content/uploads/2013/05/triple_glaze_pic.jpg

These window offer 28% - 30% (approximate) more insulation than double-glazed window (S. Forughain 2017). It also decreases thermal transfer by 75% - 80% making it the most energy-efficient option around. It also mitigates noise. Therefore, triple-glazed windows perform all the functions of double-glazed windows, but with more effectiveness. They are just marginally more expensive by 20%.

How a Triple Glazed Window Works?
Windows have many uses such as allowing light into a building. Windows also enable us to see outside from the home and, at the same time, keeping inclement weather out. All this be achieved by a window with a single pane of glass. Triple glazed units provide the more insulation against the loss of heat, wind, rain and reduce noise levels from outside the home.

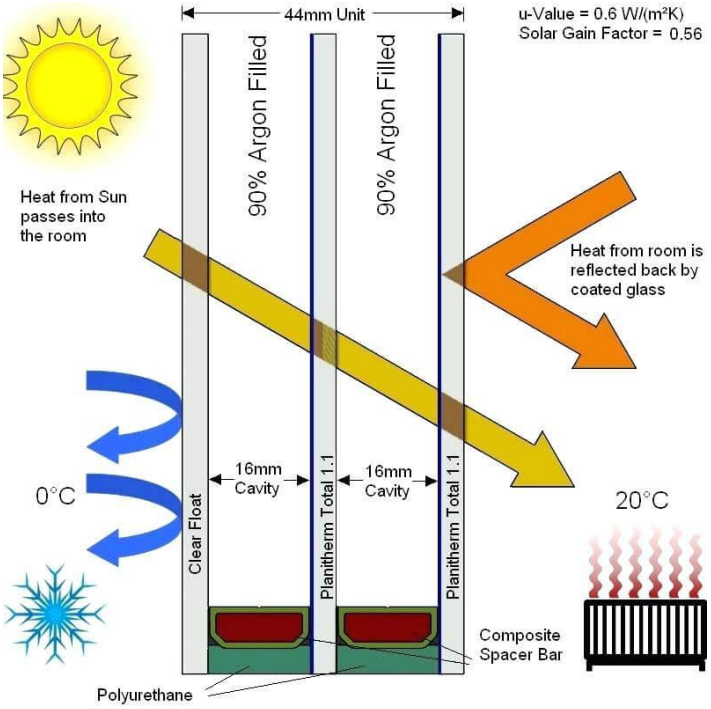


Figure 6: how triple glazed window works
Source: http://www.newquayplastics.biz/wp-content/uploads/2013/05/triple_glaze_pic.jpg

The three panes of glass may be treated with a low-emissivity (low E glass) metallic coating that reflect some of the heat back into the home in order to increase their energy efficiency and are incorporated within a rigid sealed unit with an air gap between each sheet of glass. Thereby, instead of having one air gap in the case of double glazed window, there would be two air gaps in a triple glazed window. The air gap may be filled with an inert gas such as xenon, krypton or argon to reduce the heat loss even further. The sealed unit is normally constructed of wood or uPVC (Un-plasticized polyvinyl chloride).

Benefits Of Triple Glazed Windows

These windows, when properly installed, have an extensive array of benefits. More rigid and durable than traditional windows, triple glazed windows have an outstanding insulation performance, especially in areas with extreme weather. They also are resistant to condensation and reduce sound transmission.

Their three layers of glass also provide increased security the thicker area is harder for vandals to break. Additionally, they offer great energy savings when compared to regular and double glazed windows.

Installing triple glazed windows is equivalent to upgrading your walls and ceilings from R-20 to R-40 (in certain circumstances), and they can decrease relative heat loss, which increases thermal comfort inside.

To cut costs, a combination of double glazed windows and triple glazed windows can be used with the building orientation. This is achieved by installing the triple glazed windows on the sunny part of the building and installing the double glazed windows where there is no direct sun radiation. Consider insulated hollow frames when installing your windows, as they can increase their performance, which can save you money in the long run.

Comparative Cost Of Double And Triple Glazing

When you start shopping for double glazing and/or new windows, you'll find the following affect the cost:

I. The material the window frames are made from
II. The window style

III. The type of glazing used
IV. The size of your installation
V. Existing building codes or municipal regulations.

The price of a double glazed window will depend on its quality, but you can expect to pay at least 25% - 35% more than for single glazed windows. In terms of window frames, aluminum and composite window frames are usually cheaper than timber-framed windows.

Material		
Material	**Double glazing cost**	**Triple glazing cost**
White uVPC	€350 - €430	€460 - €570
Woodgrain uPVC	€570 - €680	€680 - €770

Table 1: cost difference between double glazed and triple glazed window
Source: Leroy Merlin Company (https://www.leroymerlin.com.cy/)

Case Study

The case study of this experiment is setup for a proposed student house for Eastern Mediterranean University Located Famagusta North Cyprus. The house is 350 meters square with openings on each side. It consists of 6 bedrooms 3 livings and a study room whereby most of the living spaces are oriented to face the south side for passive solar energy gain during winter, and this can also reduce the heating load as well.

Case study Types

TYPE A (with Double Glazing Window): 20% north glazing, 10% East/west glazing, 90% South glazing 150mm EPS wall insulation

TYPE B (with Triple Glazing Window): 20% north glazing, 10% East/west glazing, 90% South glazing 150mm EPS wall insulation

Figure 7: Case study model showing the south and north façade of the model.
Source: By Author (2020)

Weather Conditions

The weather in the Famagusta area during the summer is hot and reliably sunny and during the winter is cool and humid. Following the list, you will find the average climate condition of the area.

I. Hot season / summer is in June, July, August and September.
II. Most rainfall (rainy season) is seen in October.
III. Famagusta has dry periods in April, May, June and July.
IV. On average, the warmest month is July.
V. On average, the coolest month is January and December.
VI. October is the wettest month.
VII. June is the driest month.

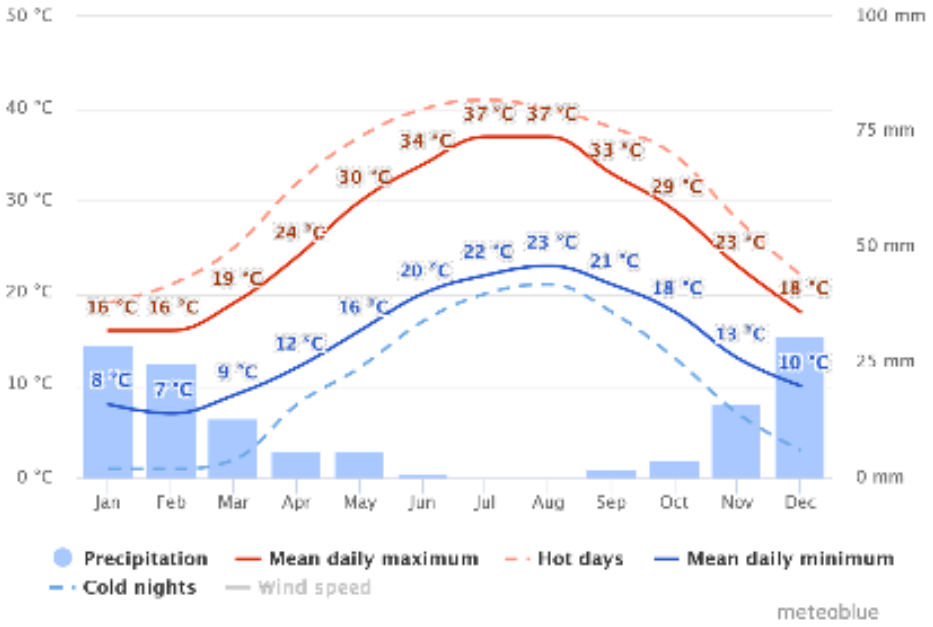


Figure 8: Graph showing the climate condition of case study location (Famagusta North)
Source: www.meteablue.com

These houses were then outfitted with various double and triple glass types, and one single glass plate type as a reference, and were then modelled and analysed using Energy Plus, a comprehensive environmental calculation and analysis algorithm for buildings. This method generates a variety of data, among which total energy use for gas and electricity, solar gains, and CO2 generation. The advantage of using such an analytical model is that various other parameters are taken into account, such as airtightness, real-world climate data on a day-to-day basis, usage characteristics, etc. Reliable and repeatable experiments can be performed in for regression testing. An experiment was done by A. Rana (2018) on an investigation on the thermal performance of double and triple glass window, the research takes into account the temperature measurements from in-situ tests that are carried in actual houses as well as laboratory experiment similar to Hot Box test. The method of this experiment is shown in the figure below;

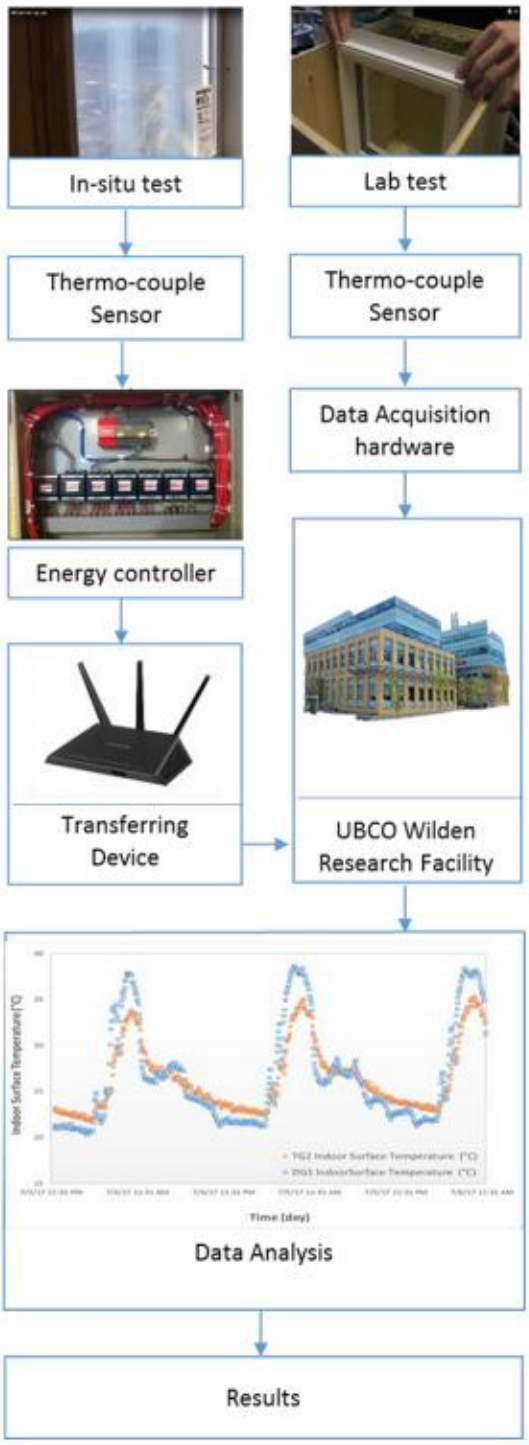


Figure 9: An investigation on the thermal performance of double and triple glass window
Source: Chen, Y. *et al.* (2025) 'Seasonal thermal performance of double and triple glazed windows with effects of window opening area.

Energy Plus does not take into account all possible physical processes that are taking place, such as temperature gradients over the glass surface, or angle dependence for solar energy transmittance'', which we predict for this experiment does not influence the results in a significant way.

Tested Glazing Type For The Scenario

There are many types of available glass that can be compared. Double glazed and triple glazed are chosen for this research. For this research, five types were tested, all commonly used products in building industry, and standardized for energy-plus calculation (energy calculation software or

simulators). A single plate glass type is used as a reference, and for each double and triple glazing unit a high performance variant is added. "UGlass" is the insulation value, and "Trans" is the transmission value. The once with "HR" means glazing with Low-E Coating in the middle of the glaze.

Type:	Single	Double	Double HR	Triple	Triple HR
Glass:	6mm helder	6mm/13mm	3mm/13mm	6mm/13mm	6mm/13mm
Filling:	-	Air	Argon	Air	Argon
Characteristics:	Uglass = 5.36 Trans. = 0.351	Uglass = 2.45 Trans. = 0.216	Uglass = 1.60 Trans. = 0.688	Uglass = 1.21 Trans. = 0.303	Uglass = 0.78 Trans. = 0.470

Figure 10: types of glasses tasted for this research

Energy Calculation

From the calculation of the energy efficiency of glass type and their application on south façade 30% is taken as a base case for the calculation and compared with the case study model that is used for the research.

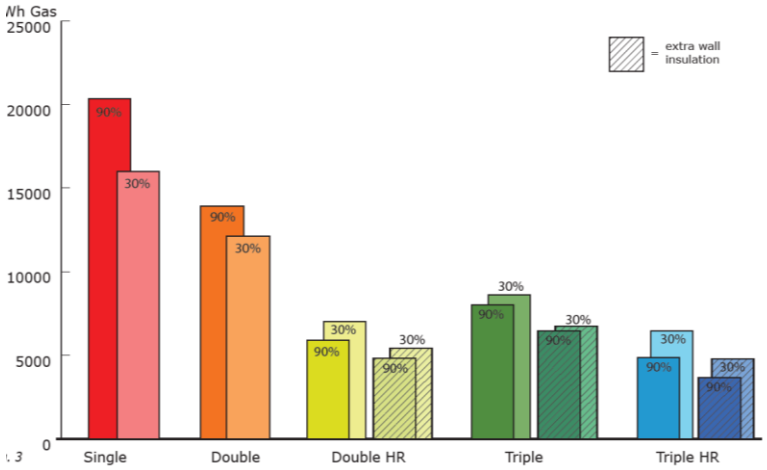


Figure 11: Energy usage of different type of glazed window.

Findings; The graph in figure 11 above shows the total energy usages of the various glazing types and for the 30% and 90% south glazing houses, as well as the models with increased wall insulation. It's immediately clear that there are large benefits to using double glazing types and beyond. It's also clear that the double HR glass outperforms the normal triple glazed unit. The double HR glass have an additional Low-E coating while the normal triple glazed only have the argon gas filled in between.

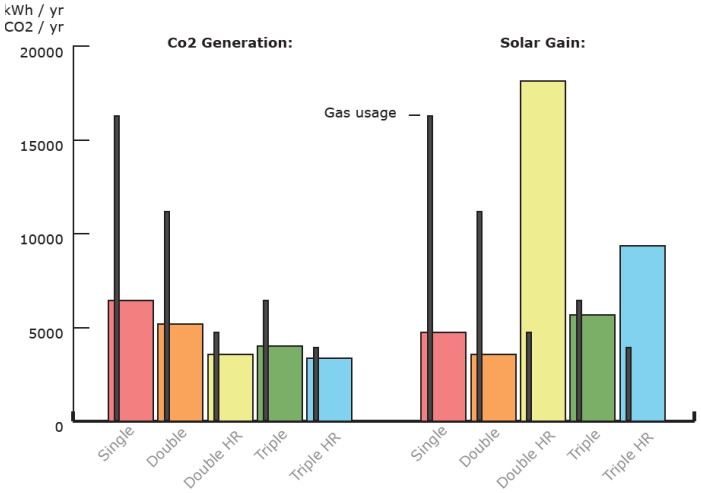


Figure 12: Graph showing gas usage and CO2 emission with solar gain of different types of glazed window.

From figure 12 above, it shows that the left side of the figure shows the gas usage versus CO2 emissions. We can see that they are related, but that CO2 emissions are not decreasing by as much as the gas usage of the entire house. This is due to other forms of energy use within the house such as electricity and water. This means that only 15% to 25% amount of CO2 reductions can be affected by glazing types.

On the right of figure 12 we can see a large difference in solar gains between the different glazing types due to the difference in transmission values. Glass with a higher transmission value admits more light and heat from the sun. In winter this has a direct effect on gas usage, and the effect is in the same order of magnitude as the gas usage itself. This explains why the double HR glass outperforms the normal triple glazing types, despite the higher insulation value of the triple glass types, because the double HR glass allows more solar energy to enter the house, which will help in heating the building interior during the wintertime of the year. Which will also drastically reduce the use of gas itself.

Recommendations

According to the tested glasses and window types, it clearly shows that in terms of energy saving as shown in figure 11, double glazed HR and Triple Glazed HR are saving more than the other types of window glazing, and they can save up to 80% more than normal single glass which is used as a reference.

In terms of solar gain, the result shows very clearly that double glazed HR has the maximum solar gain than all the other types of the glazing.
For this project, the double glazed HR glass is chosen because in term of energy saving and heat loss saving it is very efficient while the solar gain is high. This can save up to 20% to 30% of the total energy use in a building.

Cost Calculation

When you start investing for double glazing and/or new windows, you will find the following affect the cost:

I. The material the window frames are made from
II. The window style
III. The type of glazing used
IV. The size of your installation

The price of a double glazed window will depend on its quality. However, you can expect to pay at least 25% - 35% more than for single glazed windows. In terms of window frames, aluminum and composite window frames are usually cheaper than timber-framed windows.

Material		
Material	**Double glazing cost**	**Triple glazing cost**
White uVPC	€350 - €430	€460 - €570
Woodgrain uPVC	€570 - €680	€680 - €770

Table: cost difference between double glazed and triple glazed window
Source: Leroy Merlin Company (https://www.leroymerlin.com.cy/)

All houses lose heat through their and windows. It's a natural thing. But double glazing or triple glazing keeps your home warmer or cooler – as well as reducing your energy bills for heating and cooling through that. The costs and savings will be different for every home, depending on its size and the quality of the glazing types. It's expected that on a standard house, you can save

approximately 200-250euro per year, with double glazing and 250-280euro per year with triple glazing.

Scenario

Following a simplified version of the proposed case study models, I am comparing the implementation costs with the benefits gained during the life span of the products. The double glazed and triple glazed (HR) products are chosen for a period of 20 years. For the proposed student house with south glazing (12 glass openings of 2.1 x 1.2m). I am using a value of 350euro for double glazed window and 460euro for triple glazing with an interest rate of 6%.

S/no	Cost	Double Glazed Window	Triple Glazed Window
1.	Investment Cost	350 x 12 = 4200euro	460 x 12 = 5520euro
2.	Implementation cost	7 x 12 = 84 euro	10 x 12= 120 euro
3.	Maintenance cost	5euro/year	5euro/year
4.	Electricity bill saving	200euro/year	200euro/year
5.	Life span	15years	15years

Cost Calculation

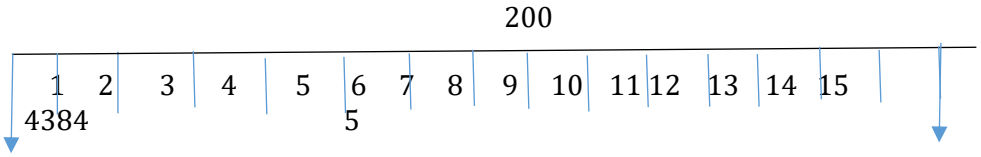
Initial cost = investment cost + Implementation cost

I. Double glazed = 4200 + 84 = 4284 euros
II. Triple glazed = 5520 + 120 = 5640 euros

Cost difference between Double and triple is 1356 euros

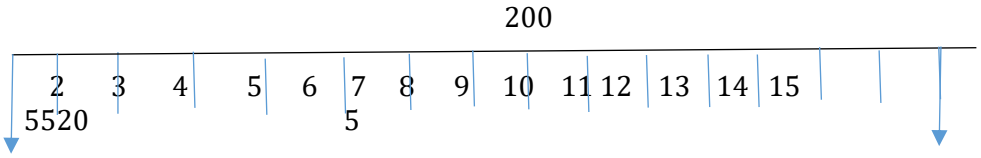
Solution

Double Glazed window



- 4384 + 5(P/A, 6%, 15) - 200(P/A, 6%, 15)
- 4384 + 5(9.712) – 200(9.712)
- 4432.56 – 1942.4
- 2490.16 euros

Triple Glazed Window



- 5520 + 5(P/A, 6%, 15) - 200(P/A, 6%, 15)
- 5520 + 5(9.712) – 200(9.712)
- 5520.56 – 1942.4
- 3626.16 euros

Cost difference = 3626.16 – 2490.16 = 1136 euros

Result And Conclusion

From the result, it shows that double glazed window is cheaper than triple glazed window with a difference of 1136 euros from the lifecycle cost calculation.

Furthermore, for the proposed case study model, it is feasible to choose double glazed window than triple glazed window according to the following terms

1. Cost lesser than triple glazed window
2. Cost of energy saving is almost the same as triple glazed
3. Have more solar gain than triple glazed

4.

S/No	DOUBLE GLAZED WINDOW	TRIPLE GLAZED WINDOW
1.	Cost less than triple glazed window	Most energy efficient glazed window
2.	Can reduce up to 50% heat loss	Lower U value than double glazed
3.	Weight less than triple glazed	Heavier than double glazed
4.	More popular than triple glazed	Safer than double glazed
5.	Less energy efficient	More expensive
6.		Better for extreme weather condition

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AN ANNOTATED BIBBLIOGRAPHY ON URBAN HEAT ISLAND EFFECT

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Abstract
Cities, towns, and urban areas differ from rural areas largely in size, population density, and the extent of man-made surface modification which make them more prone to the high solar radiation reaching the earth surface. These high temperatures cause different climate challenges as the global challenge of climate change. One of such evidence of climate change is the creation of the urban heat island (UHI) and it effect. Urban Heat Island (UHI) is a phenomena known as "an island" in which hot surface air is concentrated in urban regions and surrounding temperatures gradually decline in suburban/rural areas. This paper identifies the causes, mitigation strategies and methodologies used in the study of UHI. A systematic literature review was employed in this study. Variations in albedo, man-made structures (roads, pavements, buildings etc.), evaporation from water bodies, solar radiation falling on built areas among others were found to cause UHI. Use of cools surfaces (cool pavements, roofs), greenery as a nature based solution, green roofs, change in albedo and creation/preservation of water bodies among others were identified as mitigation strategies against UHI effects.

Keywords; Albedo climate change, eco-friendly urban heat island (UHI), urban heat island effect, urban neighbourhood, mitigation strategies.

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Introduction

Extreme temperatures caused by climate change have widespread impacts on the earth's surface, including more frequent and intense heat waves, increased risk of wildfires, and alterations in precipitation patterns. Rising temperatures also contribute to sea level rise, threatening coastal areas and ecosystems, and exacerbate water shortages in already stressed regions. It endangers the health of city developers and their well-being, as well as their thermal comfort. Urban heat islands are one of the many risks posed by climate change (Deilami et al., 2018). The structure of the atmospheric boundary layer (ABL) changes so significantly over a city that it is given its name, the urban boundary layer (UBL). It can be separated into two layers: mixed and surface. The latter is further separated into three sub-layers: inertial, roughness, and urban canopy layer (Brozovsky, 2022).

Cities, towns, and urban areas primarily have pollution, heat island, less green space, rural areas have more single family homes, zoning laws might be different too, population density, and types of activities they support and the extent of man-made surface modification. Cities are generally larger, more densely populated, and have a higher concentration of activities. Towns and semi-dense areas are in between, while rural areas are characterized by lower population densities. However, the particular criteria used to delimit these regions vary from country to country, and are difficult to define as universally applicable(Brozovsky, 2022). According to Gago et al., (2013), a city is a "permanent and densely settled place with administratively defined boundaries whose members work primarily on non-agricultural tasks". The final portion of the term already suggests a habitat that is fundamentally different from a natural landscape, with large, open, and vegetated or forested places playing only a supporting role. In contrast to the natural landscape, the urban landscape, sometimes known as the cityscape, is characterized by emissions and pollution from motorized vehicles, building HVAC systems, industrial activities, and so on. Furthermore, huge wind and sun barriers, such as buildings, and generally dark, heavy materials that are impervious to water are prevalent (Peng et al., 2018). Urban Heat Island (UHI) is a phenomenon known as "an island" in which hot surface air is concentrated in urban regions and surrounding temperatures gradually decline in suburban/rural areas (Ningrum, 2018).

As the name implies, the surface layer is dominated by thermal and turbulence influences from the urban environment. Heat flux from the ground and reduced turbulent heat transport in cities typically result in the so-called urban heat island (UHI) effect, which is one of the most investigated areas of urban climatology. It reflects the different warmth of an urban settlement in comparison to its rural surroundings and has been observed across all climate zones and settlement sizes(Brozovsky, 2022). The UHI phenomena were explained in terms of an 'urban energy balance' based on an examination of incoming and outgoing energy flux from an urban surface system (Wang et al., 2023). The energy collected by this urban surface system from solar radiation and created by human activity is thus physically balanced by warming the air above the surface (convection and radiation), evaporation of moisture, and heat storage in surface materials. The partitioning of this energy balance determines the character of the urban environment, which influences how cities consume energy as well as residents' comfort and well-being (Giridharan & Emmanuel, 2018). A variety of climate processes contribute to the creation of a UHI. This creation can be explained by events that occur in the Urban Boundary Layer (UBL) or the Urban Canopy Layer (UCL). The UBL is governed by mechanisms relevant to the meso scale, with the higher altitude thermal inversion prominent during the daylight, and the latter by those at the micro scale, with the lower altitude inversion dominant during the nighttime (Figure 1&2).

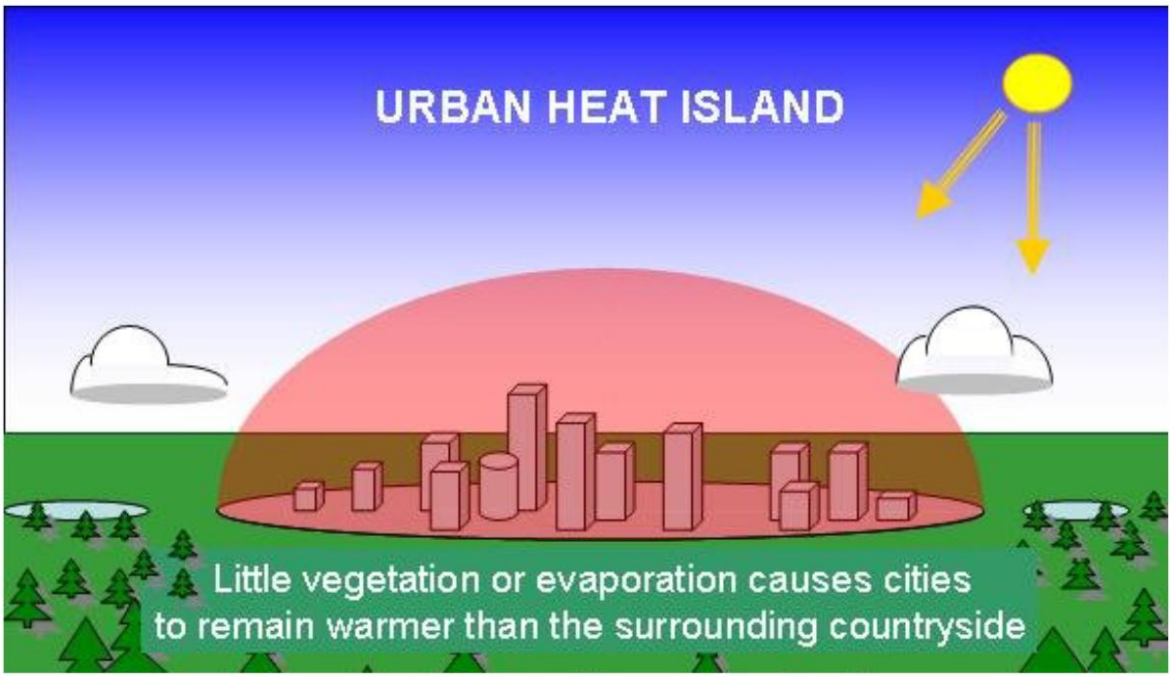

Figure 1; Urban Heat Island. Source; (Ningrum, 2018)

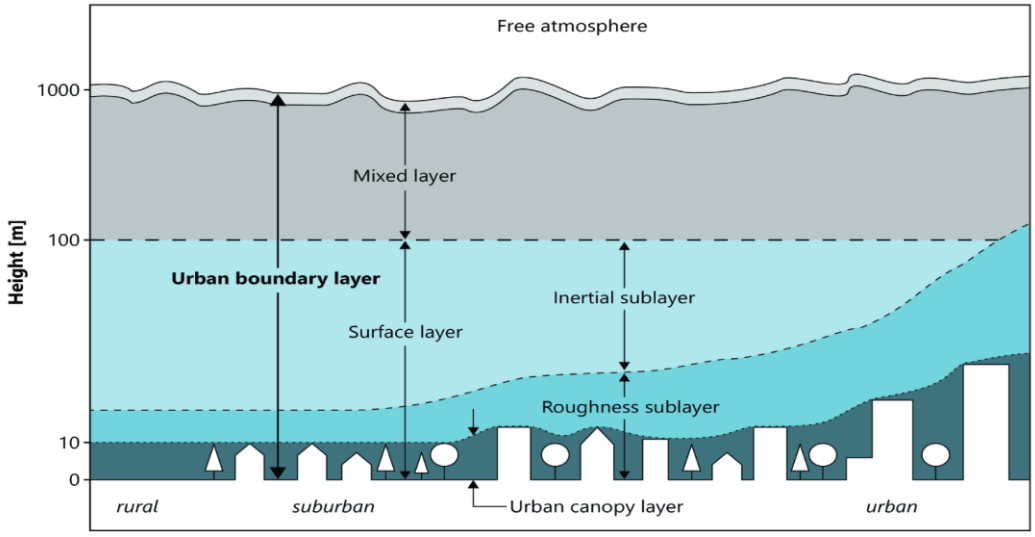

Figure 2; Schematic illustration of the urban boundary layer (UBL) structure by day. Source: (Brozovsky, 2022)

UHI is produced by various causes that differ between urban and non-urban locations. These characteristics include the release of anthropogenic energy from air conditioning systems, energy emissions from industrial operations and motor vehicles, the ratio of mixed surfaces, and the differential in heat capacity between building materials and natural structures (Ahmed, *et al*., 2020). Field verifications revealed that the majority of hotspots in metropolitan areas were located on metal roofs, industrial buildings, warehouses, airport runways, railways, high-density parking lots, and solid waste disposal facilities. Almost all hotspots have few or no green spaces (Umar & Kumar, n.d.).

Variations in albedo cause temperature differences in various regions(Shareef, 2022). Man-made structures, such as roads and buildings, often have lower albedo than natural surfaces, absorbing more visible sunlight (Martilli et al., 2020). The urban surface is typically hotter than the natural surface that contains water. Evaporation from water removes energy from the surface and lowers its temperature(Garuma, 2023). The urban surface quickly releases water, in contrast to natural

surfaces such as plants, which can retain water. Anthropogenic heat sources include heating and ventilation systems, industrial activities, and internal combustion engines. Energy usage will generate heat as a by-product. Solar radiation falling on the built area (asphalt, concrete) causes the surrounding air temperature to increase because the heat capacity of asphalt and concrete is lower than other types of surfaces(Ahmed Khozema *et al*., 2020).

The UHI effect is a type of urban heat build-up caused by urban building and human activity (Nwakaire et al., 2020). It is regarded as the most evident urban climatic characteristic. Increased land surface temperatures caused by UHI effects will inevitably affect the flow of materials and energy flows in the urban ecological system, as well as alter their structure and function, resulting in a variety of ecological and environmental effects on urban climates, urban hydrological situations, soil properties, atmospheric environments, biological habits, material cycles, energy metabolism, and population health (Lee & Kim, 2022).

UHI has a significant effect on residence energy use both directly and indirectly. UHI is associated with air conditioning equipment and raises monthly electricity bills (Ahmed et al., 2021). The increased usage of air conditioning has an impact on electric energy waste and pollution, which contributes to the greenhouse effect. Electricity use increases sulphur dioxide emissions, carbon monoxide, nitrous oxides, and carbon dioxide, all of which are greenhouse gases that contribute to global warming and climate change(Brozovsky, 2022). Furthermore, during the dry season, the heat island will hasten the creation of hazardous fog, including nitrous oxides (NOx) and volatile organic compounds (VOCs), which react with photochemistry to produce ozone on the surface (Wong et al., 2021).

The various urban forms have a considerable impact on the urban microclimate and the outdoor thermal effect. Compared to urban geometry, vast building area is not the primary factor influencing urban microclimate (Emmanuel et al., 2020). The average building height provided enough urban shade, which is a key component in determining temperature. Normally, a courtyard building model provides higher outdoor thermal comfort, but a simulation revealed that the distance between the buildings is more essential than the building type (Martilli et al., 2020). Other site-specific characteristics, such as the amount of green space, anthropogenic heat, and distance to water bodies, should be considered in addition to meteorological circumstances to explain changes in intra-urban UHI intensities(Steeneveld et al., 2014).

Given the effects and causes of UHI as discussed above, this paper aimed at reviewing relevant literature to assess the adaptation and mitigation strategies employed worldwide. This was achieved through a critical literature review.

Methodology

This study utilizes a systematic literature review to explore the various factors contributing to Urban Heat Island (UHI) effect and the mitigation strategies employed globally. The review aims to provide a comprehensive understanding of UHI causes and potential solutions for managing urban temperatures.

This research approach allows for a thorough analysis of the existing knowledge base on UHI, key factors such as:

1. **Land Use and Cover Changes:**

The conversion of natural land to impervious surfaces (concrete, asphalt) and the reduction of vegetation cover contribute significantly to UHI.

2. **Anthropogenic Heat Release:**

Energy consumption in buildings, transportation, and industrial processes generate heat that contributes to the urban heat.

3. Local Climate and Topography:
Factors like urban density, latitude, elevation, and atmospheric stability influence the intensity of the UHI.

4. Air Pollution:
Pollutants like aerosols can absorb solar radiation, contributing to surface warming and influencing the UHI.

Mitigation Strategies:
The review also examines a wide range of mitigation strategies, including:

a) **Urban Greenery:**
Increased vegetation cover through planting trees, establishing green roofs, and creating urban forests can help to lower temperatures through evapotranspiration and shading.

b) **Cool Materials and Surfaces:**
Using reflective pavements, cool roofs, and other high-albedo materials can reduce heat absorption and surface temperatures.

c) **Urban Planning and Design:**
Optimizing building orientation, layout, and design can minimize heat exposure and improve natural cooling.

d) **Passive Cooling Techniques:**
Incorporating shading structures, optimizing airflow, and utilizing evaporative cooling methods can reduce the need for air conditioning.

e) **Smart Growth Principles:**
Adopting sustainable urban planning practices that prioritize compact development, mixed-use zoning, and green infrastructure can help to mitigate UHI.

By systematically reviewing the literature, this study provides a comprehensive overview of the UHI effect and its mitigation, which can inform urban planning and policy decisions to create more sustainable and liveable cities.
Google Scholar was used as the primary source of literature. The process of searching and filtering articles was done in stages.

Searching for relevant literature
The keywords "urban heat island" were typed in the search bar of Google Scholar and 1490000 articles were displayed as the result of the search. With this high number of articles, it will be extremely difficult to filter these articles to find the most relevant for this study. As such, the second search was done. The keywords "urban heat island mitigation" were typed in the search bar. The result displayed shows 183000 articles. This number is still too large for effective selection and filtering of relevant literature to be reviewed. This led to the third search stage. The keywords "urban heat island mitigation strategies" was typed in the search bar. 171000 articles were displayed as the result of the search. To reduce redundancy, the filtering of the articles was done with year of publication.

Table 1: showing the keywords search

S/N	Search Words	Number Of Articles
1	urban heat island	1490000
2	urban heat island mitigation	183000
3	urban heat island mitigation strategies	171000

4	2016-2024	17000
5	2020-2024	300

The search was set for articles published from 2016 to 2024 and the number of the articles reduced to 17000. Then another search was done, and the year of publication was set at 2020 to 2024. The results displayed about 300 articles. These articles include duplication and those not directly addressing UHI and its mitigation/adaptation strategies.

Exclusion Criteria

The generated set of 300 articles was skimmed so the authors could familiarize themselves with the discussed themes. During this initial analysis, it was noticed that most of the articles were duplications. Therefore, criteria were developed for which articles to include in the review and which ones to exclude (see Table 2 for details).

Table 2. Shows the exclusion criteria

Exclusion criteria	**Number of articles**
Total articles after data collection	300
Articles corrupted after download	43
Duplicates	83
Articles on surface urban climate	51
Articles without UHI on the abstract	63
articles without mention of UHI in the abstract	30

After the exclusion exercise, 17 articles were selected for the review process cutting across different geographical regions and climate zones.

Discussion

To ensure a spread in the review process, the selected articles cut across all climate zones, geographic locations, and some countries from Africa, Asia and Europe (see table 3).

Table 3; shows the selected articles and their geographic locations.

S/N	**AUTHORS**	**TITLE**	**LOCATION**
1	(Leal Filho et al., 2021)	Addressing the Urban Heat Islands Effect: A Cross-Country Assessment of the Role of Green Infrastructure	14 cities in 13 countries.
2	(Abulibdeh, 2021)	Analysis of urban heat island characteristics and mitigation strategies for eight arid and semi-arid Gulf region cities	arid and semi-arid regions
3	(Rahayu & Yusri, 2021)	Bogor Botanic Gardens as a nature-based solution for mitigating urban heat island and microclimate regulation	NA
4	(C. Wang et al., 2021a)	Cool pavements for urban heat island mitigation: A synthetic review	US
5	(Zheng et al., 2022)	Evaluating Urban Heat Island mitigation strategies for a Subtropical City Centre (a case study in Osaka, Japan)	Japan
6	(Balany et al., 2020)	Green Infrastructure as an Urban Heat Island Mitigation Strategy—A Review	Australia
7	(Wong et al., 2021)	Greenery as a mitigation and adaptation strategy to urban heat	Singapore
8	(Martilli et al., 2020)	Is the Urban Heat Island intensity relevant for heat mitigation studies?	NA
9	(Qi et al., 2020)	Ontology-based knowledge representation of urban heat island mitigation strategies	Australia
10	(C. Wang et al., 2021b)	Perceptions of urban heat island mitigation and implementation strategies: survey and gap analysis	US

11	(Irfeey et al., 2023)	Sustainable Mitigation Strategies for Urban Heat Island Effects in Urban Areas	Australia
12	(Shareef, 2022)	The Influence of Greenery and Landscape Design on Solar Radiation and UHI Mitigation: A Case Study of a Boulevard in a Hot Climate	Dubai, UAE
13	(Garuma, 2023)	Tropical surface urban heat islands in east Africa	East Africa
14	(Degirmenci et al., 2021)	Understanding policy and technology responses in mitigating urban heat islands: A literature review and directions for future research	Australia
15	(Jain et al., 2020)	Urban heat island intensity and its mitigation strategies in the fast-growing urban area.	India
16	(Nwakaire et al., 2020)	Urban Heat Island Studies with emphasis on urban pavements: A review	Malaysia

The articles reviewed contained researches done across all the geographic locations and climate zone as seen in table 3. All the reviewed articles simply reviewed(Degirmenci et al., 2021; Irfeey et al., 2023; Martilli et al., 2020; Nwakaire et al., 2020; C. Wang et al., 2021a) or study the UHI effect, it formation and mitigation strategies(Abulibdeh, 2021; Garuma, 2023; Leal Filho et al., 2021; Qi et al., 2020; Rahayu & Yusri, 2021; Shareef, 2022; C. Wang et al., 2021b; Zheng et al., 2022).

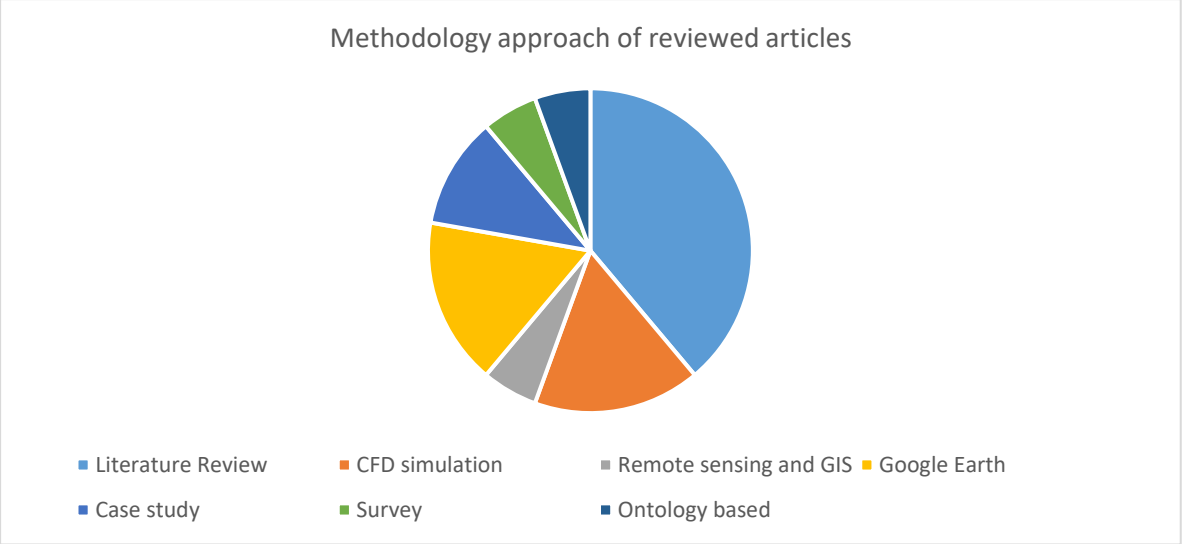

Figure 1; showing the methodology approaches used in reviewed articles.

As can be seen from figure 1, different methodologies can be employed to carry out study on UHI, and mitigation/adaptation strategies. Numerical simulation studies was done through computational fluid dynamic software called ENVI-Met(Shareef, 2022; Zheng et al., 2022). Remote sensing and GIS is another methodological approach that can be employed by researchers in the study of UHI (Abulibdeh, 2021).

Table 4 provides a complete list of the reviewed articles with their main findings and methodology used.

Table 4; showing the main findings of reviewed articles.

S/N	Research	Main findings	Methodology
1	(Leal Filho et al., 2021)	Keeping and increasing urban green resources leads to various benefits that may directly or indirectly reduce the impacts of UHI.	Case study

2	(Abulibdeh, 2021)	difference in temperatures between the bare areas and the urban areas ranges between 1 and 2 °C, between the bare areas and green areas ranges between 1 and 7 °C, and between the urban areas and green areas ranges between 1 and 5 °C.	Remote sensing and GIS
3	(Rahayu & Yusri, 2021)	Heat mitigation is proven to be one of the environmental services provided by Bogor Botanic Gardens (BBG).	Time series analysis using Google Earth Engine
4	(C. Wang et al., 2021a)	Six gaps in existing cool pavement research and five gaps related to the implementation of cool pavements in building codes, standards, and municipal projects.	Literature review
5	(Zheng et al., 2022)	The increased albedo of urban fabric material (scenario B Cool pavement model) showed the most efficient to mitigate UHI.	CFD simulation using ENVI-Met.
6	(Balany et al., 2020)	It was observed that the majority of the research was conducted on a limited spatial scale and focused on temperature and human thermal comfort	Literature review
7	(Wong et al., 2021)	The cooling potential varies markedly, depending on the scale of interest (city or building level), greenery extent (park shape and size), plant selection and plant placement.	Literature review
8	(Martilli et al., 2020)	Demonstrates that the Urban Heat Island intensity has little relevance for urban heat mitigation and suggest the term “urban heat mitigation” to more accurately describe strategies aimed at cooling cities.	Literature review
9	(Qi et al., 2020)	A prototype for the UHIMS representation is introduced covering the use of ‘UHIM techniques’ having ‘Planning and design variables’ on ‘The place of application’ to address ‘UHI problems’ in ‘Urban settings’ with the evaluation by ‘Performance metrics’.	ontology-based representation of UHIMS
10	(C. Wang et al., 2021b)	Four knowledge and implementation gaps identified: the lack of public education on UHI mitigation and implementation measures, the lack of effective communications between researchers and code writers, the lack of implementing UHI mitigation strategies in some countries, and the lack of trustworthy information shared on social media.	Questionnaire survey
11	(Irfeey et al., 2023)	Materials such as reflective street pavements, coating materials including light-colored paint, phase-change materials, colour-changing paint, fluorescence paint, and energy-efficient appliances are considered sustainable materials, whereas green infrastructure like green roofs, green walls, green parking and pavements, and shaded streets are considered to mitigate the urban heat island effect	Literature review

12	(Shareef, 2022)	The results showed that 12 m trees and the cylindrical tree are the most effective vegetation in reducing the air temperature; the variation between these scenarios and the existing case reaches 0.70 ◦C and 0.66 ◦C, respectively.	Case study and CFD simulation using ENVI-Met
13	(Garuma, 2023)	The mean temperature contribution to regional climate from 2000 to 2020 is 0.64^{0}C during the day and 0.34^{0}C during the night, a mean total of around 0.5 ◦C, and a 0.25^{0}C increase per decade and a quarter in global surface temperature, ≈ 1.09^{0}C from 2011 to 2020 compared to the 1850–1900 level.	Quantitative analyses using earth observation information
14	(Degirmenci et al., 2021)	(a) evidence base for policymaking including timescale analysis, effective policymaking instruments as well as decision support and scenario planning; (b) policy responses including landscape and urban form, green and blue area ratio, albedo enhancement policies, transport modal split as well as public health and participation; (c) passive technologies including green building envelopes and development of cool surfaces; and (d) active technologies including sustainable transport as well as energy consumption, heating, ventilation and air conditioning, and waste heat.	Literature review
15	(Jain et al., 2020)	It is evident from the observation that the temperature is very high within the city core as well as certain surrounding areas of the city, especially on the southern side.	Time series analysis using Google Earth Engine.
16	(Nwakaire et al., 2020)	Addressing the harmful effects of UHI would involve adoption of effective mitigation strategies that can improve the environmental, societal, and economic sustainability of urban structures and landscapes	Literature review
17	**(Oke, T.R. 1982)**	The Energetic Basis of the Urban Heat Island. This foundational paper lays out the energetic basis of UHI, including the role of solar radiation, anthropogenic heat sources, and the effect of urban structures on energy balance.	Oxford Bibliographies.
18	**(Oke, T.R. 1981)**	City Size and the Urban Heat Island. This study explores the relationship between city size and the intensity of the UHI, highlighting how larger cities tend to exhibit stronger UHI effects.	Oxford Bibliographies.
19	**(Voogt, J.A., and Oke, T.R. 2003)**	Urban heat island effects and mitigation: A review. This review provides a comprehensive overview of the UHI, its causes, and various mitigation strategies, including cool roofs, green roofs, and urban planning techniques.	Research Gate.

20	**(Feyisa, G.L., Dons, K., and Meilby, H. 2014)**	Efficiency of parks in mitigating urban heat island effect in Addis Ababa. This study investigates the effectiveness of urban parks in reducing UHI intensity, focusing on factors like canopy cover, species composition, and spatial design.	Taylor and Francis Online
21	**(Li, X., Stringer, P., and Dallimer, M. 2021)**	Topography and construction materials as contributing factors to UHI. This research examines the role of topography and building materials in influencing the intensity of the UHI, highlighting the importance of considering these factors in urban planning.	Taylor & Francis Online.
22	**(Wong, S.W.Y., et al. 2017)**	Impacts of urban heat island effect on human health and thermal comfort. This study explores the health impacts of UHI, including increased thermal stress, respiratory illnesses, and heat-related mortality.	ScienceDirect.com
23	**(Li, Y-Y., Zhang, H. and Kainz, W. 2012)**	Monitoring patterns of urban heat islands of the fast-growing Shanghai metropolis, China: Using time-series of Landsat TM/ETM+ data.	*International Journal of Applied Earth Observation and Geoformation, 19: 127-138.*
24	**(Kato, S. and Yamaguchi, Y. 2005)**	Analysis of urban heat-island effect using ASTER and ETM+ data: separation of anthropogenic heat discharge and natural heat radiation from sensible heat flux.	*Remote Sensing of Environment, 99: 44 - 54.*
25	**(Yuan, F. and Bauer, M.E. 2007)**	Comparison of impervious surface area and normalized difference vegetation index as indicators of surface urban heat island effects in Landsat imagery.	*Remote Sensing of Environment,* 106: 375 - 386.
26	**(Zhou, D., Zhao, S., Liu, S., Zhang, L. and Zhu, C. 2014)**	Surface urban heat island in China's 32 major cities: Spatial patterns and drivers.	*Remote Sensing of Environment, 152: 51-61.*
27	**(Peña, M.A. 2008)**	Relationships between remotely sensed surface parameters associated with the urban heat sink formation in Santiago, Chile.	*International Journal of Remote Sensing. 29(15): 4385 - 4404.*
28	**(Rasul, A., Balzter, H. and Smith, C. 2015)**	Spatial variation of the daytime Surface Urban Cool Island during the dry season in Erbil, Iraqi Kurdistan, from Landsat 8.	*Urban Climate, 14(2): 176-186.*
29	**(Gluch, R., Quattrochi, D.A. and Luvall, J.C. 2006)**	A multi-scale approach to urban thermal analysis.	*Remote Sensing of Environment, 104: 123-132.*

30	**(Dousset, B. and Gourmelon, F. 2008)**	Satellite multi-sensor data analysis of urban surface temperatures and land cover.	*ISPRS Journal of Photogrammetry & Remote Sensing, 58: 43-54.*
31	**(Buyantuyev, A. and Wu, J. 2010)**	Urban heat islands and landscape heterogeneity: linking spatiotemporal variations in surface temperatures to land-cover and socioeconomic patterns.	*Landscape Ecology, 25: 17-33.*
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32	**(Peterson, T.C. and Owen, T.W. 2005)**	Urban heat island assessment: metadata are important.	*Journal of climate, 18(14): 2637 - 2646.*
33	**(Rosenzweig, C., Solecki, W.D., Parshall, L., Chopping, M., Pope, G. and Goldberg, R. 2005)**	Characterizing the urban heat island in current and future climates in New Jersey.	*Environmental Hazards, 6: 51 - 62.*
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39	**(Arnfield, J.A. 2003)**	Two decades of urban climate research: a review of turbulence, exchanges of energy and water, and the urban heat island.	*International Journal of Climatology*, 23: 1 – 26.

40	**(Baik, J.J. and Kim, Y.H. 2000)**	Dry and moist convection forced by an urban heat island.	*Journal of Applied Meteorology, 40(8): 1462-1475.*

Degirmenci et al., (2021) looked into policy and technology responses to increased temperatures in urban heat islands (UHIs) and identified the following; (a) evidence base for policymaking including timescale analysis, effective policymaking instruments as well as decision support and scenario planning; (b) policy responses including landscape and urban form, green and blue area ratio, albedo enhancement policies, transport modal split as well as public health and participation; (c) passive technologies including green building envelopes and development of cool surfaces; and (d) active technologies including sustainable transport as well as energy consumption, heating, ventilation and air conditioning, and waste heat. Based on the findings, presented a framework to guide future research in analysing UHI policy and technology responses more effectively in conjunction with each other.
Previous studies focused on studying Urban Heat Islands (UHI) on a specific level, (Shareef, 2022) investigates the impact of greenery on different levels and three types of UHI, pedestrian, canopy, and boundary, to provide a holistic image of greenery impact on the atmosphere, and simulate different scenarios based on vegetation type and Leaf Area Density (LAD) using ENVI-met.

The effectiveness of UHI mitigation measures can be affected by public perceptions during planning and implementation processes, Wang et al., (2021b) leverages the results of a carefully designed survey to fill this research gap. The perceptions of professional respondents are largely affected by the geographic areas they work in and partially affected by how familiar respondents are with the UHI-related building codes and regulations and the lack of public education on UHI mitigation and implementation measures, the lack of effective communications between researchers and code writers, the lack of implementing UHI mitigation strategies in some countries, and the lack of trustworthy information shared on social media(C. Wang et al., 2021b).

Conclusion
In conclusion, mitigation strategies and different methodological approaches to UHI study have been reviewed and discussed. Researchers are at liberty to choose the method that will suit their research needs and employ in their future research work.

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ISSUES, CHALLENGES AND INTERVENTION ON TRANSPORTATION SYSTEMS IN THE CONSTITUTIONAL CONFERENCE REPORT 2014

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Abstract
Transportation infrastructure, including roads, bridges, rails, airports, seaports and the like, significantly contributes to Nigeria's prosperity. Transportation planning is a fundamental component of sustainable development, particularly in developing regions burdened by infrastructural deficits and institutional constraints. The Transportation planning intervention strategies focused on regions like Gusau (Kaura-Namoda)-Funtua. Zaria-Kaduna-Kano, Bauchi-Gombe-Damaturu-Maiduguri and Jimeta–Mayo-Belwa-Jada-Ganye-Toungo corridors. The objectives of the study identified strategic solutions to prevailing transportation challenges. The study embarked on a comprehensive review of secondary data, including peer-reviewed academic literature, policy documents, and relevant case studies. Findings reveal that the transportation network in the study areas is predominantly road-based, yet suffers from congestion, poor maintenance, and inadequate connectivity. Rail transport is significantly underutilized, despite its potential to support freight and intercity movement. Water transport, particularly viable in riverine zones, remains largely neglected, while air transport is limited by high costs and infrastructural inadequacies. This paper explores how the intervention and incorporation of transportation system in the constitutional conference report could improve infrastructure performance. In conclusion, the study advocates for a systemic, multimodal, and adaptive transportation planning model, modernization of transport infrastructure, integration of land use, reform of policy frameworks, promotion of sustainable and inclusive mobility, active stakeholder engagement, It recommends to improve intervention on physical and social infrastructure, institutional capacity enhancement, technological adoption, and inclusive governance as critical steps toward improving regional mobility, reducing spatial inequalities, and supporting broader socio-economic development goals.Other recommendations include the need the need for actualization of the principle of integration and intervention among the constitutional conference committee members in key sectors and The Town Planners Registration Council (TOPREC) and Nigeria Institute of Town Planners (NITP) will be integrated, incorporated, and intervene in Transportation Master Planning document of constitutional conference report (2014) which may be passed into law to prevent the abuse of the planning profession globally.

Keywords: Infrastructure, Transportation, Intervention, Incorporation, Challenges, Constitution, Conference, Technology

Introduction

Transportation infrastructure significantly contributes to a nation's prosperity by facilitating workers' access to employers, consumers' access to shopping and leisure activities, and firms' access to capital, labor, and potential customers. The transportation sector has generally provided the vast amount of a nation's infrastructure—roadways, waterways, railways, and airways and expanded it to satisfy users' growing demand for transportation. But as demand has increased and aging infrastructure facilities have required ever-greater funds for maintenance and new construction, capacity has become increasingly strained, and travelers and shippers have experienced more congestion and delays. Policymakers have tried to find new sources of money to finance projects to expand capacity, but congestion and delays have persisted.

The Nigerian transportation sectors, all transport investments need to be subject to careful analysis to ensure that the benefits, net of the costs, meets appropriate investment criteria and represent value for money, while policies and plans are practical and sustainable (Zhao, et al. 2020). The Government's policy objectives should address how the demographic and economic trends will affect future transport demand and their implications of the twentieth century, aging the population, rising fuel price increasing urbanization improving travel option. This paper will discuss the roles of Town Planners in respect of transportation policies, planning procedure in constitutional conference report, (2014) and how it can respond to these changes demands. The Town Planners Registration Council (TOPREC) and Nigerian Institute Of Town Planners (NITP) these professional bodies play a role of *intervention* and create the future, so it is important that we consider the overall context of long planning decisions, good planning does not simple extrapolate trend, it investigate underlying factors that causes change and with a view to raising the standard of living of its citizens. In pursuance of this, the paper present the intervention as an act of God and ultimate purpose of Urban and Regional Planning profession (Ibn Sina, 2005).

it also expounds the rational incorporation, review development/prosperity/happiness measures placing the roles in their respective developmental status in global perspectives. The choice of these cardinal area of issues, challenges and intervention on transportation systems in the constitutional conference report 2014, has been based on nothing but their relative importance: Man's continuous existence on earth or in any settlement is a function of that environment; the joy of continuous existence as well as the pride and hope of dwellers on a given settlement are all functions of the physical and socio-economic environment of the settlement.

Infrastructure is the basic physical and organizational structures needed for the operation of a society like industries, buildings, roads, bridges, health services, governance and so on. It is the enterprise or the products, services and facilities necessary for an economy to function. Infrastructure can be described generally as the set of interconnected structural elements that provide framework supporting an entire structure of development. Achieving a set of objectives through research questions in transportation system, it is an important term for judging a country, region or state's and individual's developments/status.

The term typically refers to the technical structures that support a society, such as roads, water supply, sewers, electrical national grids, telecommunications, and so forth, and can be defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions" (Fulmer, 2009). Viewed functionally, infrastructure *facilitates* the production of goods and services, and also the distribution of finished products to end-users (markets), as well as basic social services such as schools and hospitals; In military parlance, the term refers to the buildings and permanent installations necessary for the support, redeployment, and operation of military forces (Department of Defense Dictionary, 2005).The Challenges of Infrastructure Development in Democratic Governance FIG Working Week (2012) knowing to manage the territory, protect the environment, evaluate the cultural heritage. Governance can be described as "the total ability to organize, synthesis and direct the various actions

of the working parts of government machinery in order for such government to perform meaningfully.

Aim and Objectives

The aim of this paper is to review issues relating to challenges in transportation system in Nigeria
This research questions answer following objectives:

i. What is the current condition of transportation infrastructure in the study areas?
ii. What are the major challenges affecting transportation systems in these corridors?
iii. How does the state of transportation infrastructure affect spatial planning and development?
iv. What planning and policy interventions are required to enhance sustainable transportation systems?

The objectives were set for the study:

i. To describe the nature of transportation systems in Nigeria in general and Northeast in particular.
ii. To review the transportation policy and framework in the constitutional conference report
iii. To find out the environmental, social and economic impacts of the transportation system in particularly air, land (road and rail) and sea /water in Nigeria.
iv. To proffer appropriate planning recommendations which will enhance significant overall positive transportation systems of Nigeria in the constitutional conference report.

The Town Planner making a case for evidence base on infrastructure development intervention in the constitutional conference report with a view to raising the standard of living of its citizens. In pursuance of this, the paper present intervention as an act of god and the ultimate purpose of the Urban and Regional Planning Profession. The paper further identifies intervening strategies and intervention policies as well as the principles of intervention. Consequently, the paper underscores the need for intervention in the infrastructure development situation bearing in mind evidence based on constitutional conference reports and other economic issues.

Infrastructure Development and Intervention Strategies for Transportation Planning

The Planning Intervention Strategies for Transportation Planning outlines essential strategies for modern transportation planning, focusing on sustainable development, economic vitality, and social inclusion. It highlights the need for infrastructure modernization, integrated land use and transport planning, providing a comprehensive overview of contemporary transportation planning challenges and solutions.

The key issues include:

i. Infrastructure Modernization and Upgrading

The importance of continuous investment in transport infrastructure to meet rising travel demands and reduce congestion. It emphasizes upgrading roads, bridges, rail lines, and intermodal terminals to enhance connectivity and reduce transport-related costs (Smith & Zhao (2021) and (Kumar et al. (2020).

ii. Integrated Land Use and Transport Planning

Chen et al. (2019) and Lee & Park (2022) revealed that there is need to align land use patterns with transportation networks through Transit-Oriented Development (TOD). This approach supports mixed-use development around transport hubs, minimizes urban sprawl, and fosters walkable communities.

iii. Use of Geographic Information Systems (GIS)

GIS is a tool for spatial data analysis, mapping, and route optimization Garcia & Flores (2023) and Wang et al. (2021) for supporting and enhancing transport planning by identifying service gaps and managing assets in real-time.

iv. Policy and Institutional Reform

Johnson & Ahmed (2020) affirmed that there is need for strategic reforms to build institutional capacity and align policies across different levels of government. It highlights the role of public-private partnerships (PPPs) in mobilizing funding and expertise (Mwangi et al.2022).

v. Multimodal Transport Integration

Patel & Singh (2021) and Torres et al. (2023) Asserted that integration of road, rail, air, and water modes is discussed as a means to enhance system efficiency and ensure seamless logistics. Also emphasizes the role of water transport in complementing road infrastructure.

vi. Sustainable and Inclusive Transport

Sustainability and inclusiveness are key themes Zhao et al. (2020) focusing on low-emission vehicles, non-motorized transport, and climate-resilient infrastructure. UN-Habitat, (2021) study stresses equitable access for all users, including vulnerable populations.

vii. Community Participation and Stakeholder Engagement

Martinez & Lopez (2019) highlights the importance of engaging communities and stakeholders to improve project outcomes and ensure transport systems meet local needs. Participatory approaches enhance transparency and ownership (Singh & Kumar, 2022).

viii. Monitoring, Evaluation, and Adaptive Management

Robust monitoring and evaluation frameworks are essential for assessing transport intervention performance. The importance of adaptive management is highlighted through regular feedback and data-informed adjustments (Nguyen & Tran (2021) and (Lee et al. (2023).

Planning and the Genesis of Intervention

Beginning from the very beginning, Town Planner declares that God is an intervener and that the Urban and Regional Planner is His imitator (Rogers et al. 2015). From Day one, God has been intervening in the course of events of the universe. He placed man in the Garden of Eden to manage it, but man fouled it. He intervenes and has been intervening (Madueme, 2019). The Urban and Regional Planner has been a major hand of God in the intervention process. Indeed, planners cannot be non-interventionist, because planning is intervention by design (East Riverside Workshop, 2011). In the words of Campbell and Faintestein (1996),

> "Planning is intervention with an intention to alter the existing course of events. The timing and legitimacy of planned intervention therefore becomes questions central to planning theory". Also view that "Indeed, the ultimate aim of planning is intervention to change the given socio-environmental ordering in a certain manner. Like any intervention, this is a violence act, it erases at least partly what is there in order to erect what is new and different".

Whenever people are unsatisfied with the existing situation and there is a desire for betterment or an alternative line of action rather than keeping the status quo, it can be presumed that planning is taking place, and that indeed is intervention. Planning has then been defined primarily as a way of thinking about social and economic problems planning is predominantly oriented toward the future,

is deeply concerned with the relation of goals to collective decisions and strives for comprehensiveness in policy and programme (Glasson, 1978, Ilesanmi, 1998).

Plate1: The urban transportation in US

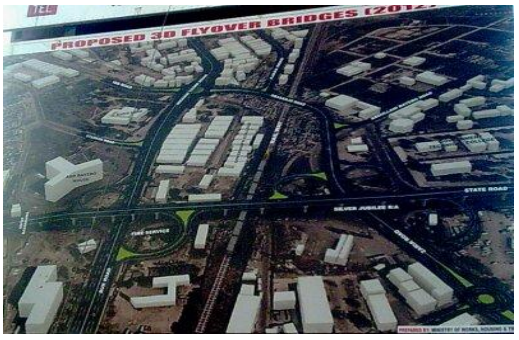


Plate2: The urban transportation in Kano

Source: Field Survey 2015

Whenever these modes of thought are applied, there is a presumption that planning is being done. And whenever solutions, particularly physical environmental solutions are being sought; an intervention process is on course. Thus, the planners are an intervener. The better imagined than experienced without professional interventions. The fly over were originally multiple accident points but for planned interventions, the cherished tourism sites were but wild until the planners intervened etc. consider how the introduction of water supply borehole, solar powered energy source; school or clinic can reduce daily distance traveled in a rural community and improve the unsatisfactory livability (Alcott and Rogers 2014). The planned infrastructure a fundamental facilities and systems serving a country, city or area) are what make a settlement to functions well (Veenhoven, 2021). The point here is that the chaos is anticipated, a desirable goal is set alternative solutions advanced and the most acceptable alternative is chosen before all other actions are implemented: That is planning and indeed it is intervention in action.

The Intervention Concept

Generally, intervention is understood to mean act of deliberately entering into a situation in order to influence events or prevent undesirable consequences. (Gollwitzer et al, 2006). Positive Influence and prevention of undesirable consequences are our interest here. These may be direct or indirect and to context, infrastructure intervention. Interventionism is a political interference or military involvement by one country in the affairs of another. It is also an action by a government to influence and improve the country's economic situation or some aspect of it (Thaler et al, 2008).

The Guinness Book of Records is adorned with names of people who intervened in their worlds – be it in science, technology, medicine, arts or music. To be earth-worthy is to influence the course of events for the better, after all, our goal in life should be to leave the stage better than we met it. That is the intervener's real meaning of development. Philosophically still, the essence of successfully crossing a stream is not just to lay a historical claim but to tell our story so that all who would successfully negative the stream will sail safe via the safe routes we have found. Such is the principle of intervention; lest others get lost when we ought to have shown them the way. Intervention has been used in this paper a very wide sense particular interference, involvement, mediation and intermediation in improving the living condition in cities, towns and villages of Nigeria; it has not been limited to the provision of fund for a specific purposed only or mere advocacy for a particular line of action. It is rather an all-embracing process beginning with the anticipation/contemplation to the executive and sustainability of a development agenda to make our world better than we met it. Advocacy raises awareness but fund provision is nothing if not well channeled. Planning believes in dreaming dreams both small and great and seeing the dreams come through.

Rationale for Intervention

We intervene because we want development. The human fingers mirror the human society in which there are the haves and the have not's. While celebrating the glories of our Billionaire Quarters, the

affluence to the rich and the satisfaction of the well-to-dos, there are situations of human miseries and disparities in the slums, ghettos and villages. There is the developed and the underdeveloped, the rich and the poor, as well as the wealthy and the impoverished in the society. There is an ever-widening gap between the haves and the have-nots resulting in the rich getting richer and the poor getting poorer! We intervene to bridge this gap, i.e. to meet needs and thus bring about development, growth and progress.

Development brings about the satisfaction of human needs and aspiration; and sustainable development requires meeting the basic needs for all and extending to all the opportunity to satisfy their aspiration for better life (Rahman, 1991). Simply put, it is believed that a settlement is developing when poverty, unemployment, inequalities and dependence have declined from high levels. We intervene because this four-headed monster exist; under development. We intervene because single urban families with their family doctors, there are several villages without the minimally qualified health worker. Whereas potable water is available to irrigate the urban gardens, the basic pre-occupation of many village women and children is fetching water from distant places every morning; and whereas the urbanites warm or cool their houses with electricity, the villager depends solely on the firewood to survive. Such disparities, when passionately thought of and appropriate actions devised to interfere, intervention is simply being carried out. It is to correct imbalances, bring in justice and equity and to reduce if not eliminate the manifestation of human miseries, gender disparities and unjustifiable class distinction. We intervene to raise the standard of living, enrich the quality of life, boost livability, extend welfare and indeed achieve growth, progress, sustainable development and overall prosperity, especially of the under-privileged. In an attempt to properly place the accent of development where it belonged, the view of the National Planning Ministry of Nigeria (1980, pp20-21) as quoted by Koinyan (1990) is relevant:

> True development must mean the development of man – the unfolding and realization of his creative potential, enabling him to improve his material conditions of living, through the use of resources available to him. It is a process by which man's personality is enhanced; and it is that enhanced personality-creative, organized and disciplined – which is the moving force behind the socio-economic transformation of society. It is clear that development does not start with goods and things; it starts with people - their orientation, organization and discipline. When the accent of development is on things, all human resources remain latent untapped potentials and a society can remain poor amidst the most opulent material resources. On the contrary, when a society is properly oriented, organized and disciplined, it can be prosperous on the scantiest basis of natural wealth.

The strategies for African development which Asante, (1991) summed up as human capital development. Although the focus is development, growth and progress are also key issues for the development planner, Boudeville (1966:168-169) is distinguished in differentiating the three concepts: Growth is merely a set of increases in quantities produced; development is growth plus a favorable change in production techniques and in consumer behaviour; progress is development plus a diminution of social tensions between groups within a society. Growth has rather been portrayed as the harbinger of development; the factor with which development can be perceived. Recognizing the place a progress therefore, the United Nations Development Programme (UNDP) publishers an annual mirror of the world called The Progress Of Nations. Other modern measures of development and prosperity are focusing on progress or sustainable development; a term commonly defined as economic and social development that meets the needs of the current generation without undermining the ability of future generations to meet their own needs. It is expected to be:

1) Socially desirable – fulfilling people's cultural, material, and spiritual needs in equitable ways.
2) Economically viable – paying for itself, with costs not exceeding income.

3) Ecologically sustainable – maintaining the long-term viability of supporting ecosystems.

Sustainable development will entail integration of these three objectives where possible and making hard choices and negotiating trade-offs between objectives where integration is not possible. These negotiations will be greatly influenced by factors such as peace and security, prevailing economic interests, political systems, institutional arrangements, and cultural norms. Although there are diverse ways of understanding development because of our professional differences, sustainable development is highly priced in all disciplines. Nyerere,(1968) is quoted as saying development is the development of people; improvement of roads, buildings, increase in the number of schools can be regarded as development only if these buildings can be, and are being, used to develop the minds of understanding of people.

Problem of Intervention

There are several regrets associated with various intervention projects. In the light of these problems, Gunning (2006) is of the view that donors are becoming increasingly interested in establishing rigorously whether the aid they provide to developing countries is effective. Most evaluation works he reviewed (Duflo, 2005; Esterly, 2006; Ravallion, 2001) used macro (national) economic indicators to establish that the impact of bottom-up approach in his paper to establish that the impact of development assistance is felt at the micro level. This work suggests that effectiveness is better measured on the individuals rather than the nation since development aids squandered by a part of the system may not show on the individual. This sums up what woes have befallen several

The Nature of Infrastructures in Nigeria

Infrastructure development is one of the bases of assessing the achievements of democratic leaders and it is the foundation of good democratic governance. Agitation for infrastructural development is higher in democratic government than in military dictatorship or compared to developed countries. This is because the resources for provision of infrastructure are always scarce. Ethnic-interest agitation and lobbying are common things in democratic governance in developing countries. This is why the Office of Government Commerce (OGC) in United Kingdom, advised that infrastructure project initiation should be done by an office specifically established to do this job. (P3O, 2008). The Infrastructural report of Nigeria just like any third world country is nothing to write home about. The housing situation is in a sorry state both quantitatively and qualitatively (Agbola, 1998; Ajanlekoko, 2001; Nubi, 2000; Onibokun, 1996 Oyedele, 2006).

Most infrastructures are now decayed and need repair, rehabilitation or replacement. Government is the system that plans, organizes, controls and supervises the people who are resident in an area in other for all to have conducive environment for living and a sense of belonging. Governments have the power to put in place all measures that it deem fit will make an environment beneficial for living for everybody. Infrastructure development in democratic governance is more challenging because of the accessibility of people to government and involves identifying the right project, carrying out feasibility and viability studies and embarking out physical development of the project.

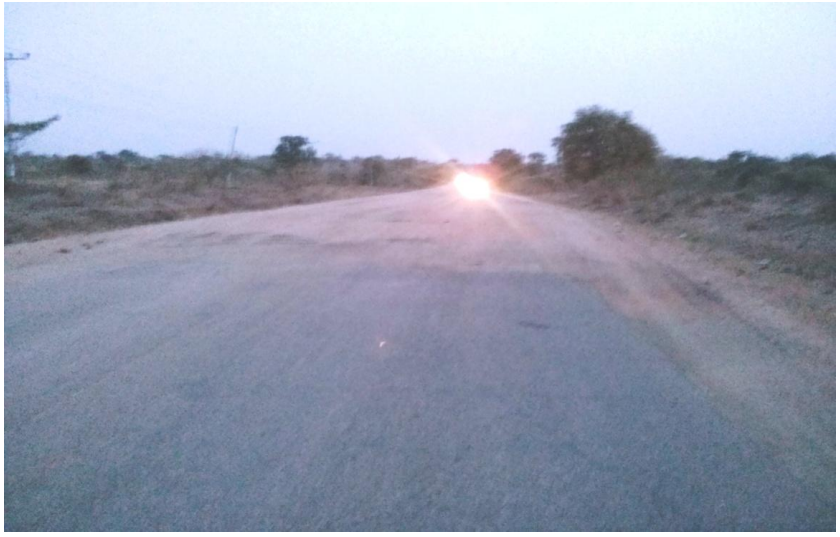
The challenges are numerous and include finance, technology for development, maintenance and design. The challenges also include quality requirements of projects to meet international standard and to be sustainably developed. Projects must meet the carbon emission standard set by international organizations like International Standard Organization. TS01C – Construction Economics and Management I, 6119 4/15 Olufemi Adedamola Oyedele.

The Challenges of Infrastructure Development in Democratic Governance FIG Working Week 2012 Knowing to manage the territory, protect the environment; evaluate the cultural heritage Rome, Italy, 6-10 May 2012 Settlements must be bio-diversified with co-habitation of other animals and plants and natural environment must be conserved for sustainable development and so on. Tradesmen and other technical human resources needed for infrastructural development are scarce because of lack of training and motivation. “As a result, many professional people, tradesmen and

senior managers are immigrating to other countries" (Robbins et al, 2009). Because of fast money, most youths that supposed to learn a trade are now "commercial bicycle riders".

The numerous challenges have not been tackled as they should. Nigeria's lack of basic infrastructure to facilitate sustainable development and trade – both regionally and globally – and to ensure competitiveness is already known by all. In particular, for the large number of local governments, especially the rural ones, the dwellers produce have no access to markets and are not stored, hampered by weak transport and energy infrastructure.

Fig. 1: Nigeria Showing Rail, Road, Water and Air Transports.
Source: www.mapsofworld. 2014



Plates 3: Mayo-Belwa, Jada, Ganye, Toungo Trunk 'A' Road,
Source: Field Survey, 2015

The key elements in this approach are provision of infrastructure through:

(a) Empowerment of people
(b) Development of an administrative process, which responds to the needs of the people
(c) Human growth and wellbeing
(d) Equality
(e) Self-reliance

(f) Participation and
(g) Sustainability.
White (1987: 60) argued that sustainability is a measure of lasting quality in development programmed. An infrastructural development programme can be sustained by creating a felt need among beneficiaries about the efficacy of the programmed, developing institutions which continually adapt, providing (or self-generating) resources and building support among political elite and community groups.

Intervention Principles, Strategies, Techniques and Best Practices
Intervention works best when there are needs i.e. felt need, when recipients are cooperative, when it is not just development from above but home grown, when the intervention is a foreign ideas but has been appropriately communicated, when the community owns the development project, when appropriate technology is being utilized. Briefly put, the first principle of intervention is to recognize the centrality of power. Community empowerment and ownership should be the main goal of interventions. Individuals and communities become empowered by gaining knowledge about specific issues, communicating about issues of common concern, making decisions for themselves and negotiating power relations. A second key idea is to integrate the top-down and bottom-up approaches**.** The first wave of development utilized the top-down approach and has been heavily criticized giving birth to the bottom-up approach. After the pendulum swung from government-led to community-based approaches in the 1970s and 1980s, there has been a growing realization that top-down and bottom-up communication strategies are necessary to tackle a host of problems successfully.

Appropriateness of Intervention whether initiated top-down or bottom-up is key to community participation (Garta and Ilesanmi, 2008). It should involve appropriate technology, which is affordable or with justifiable cost, culturally acceptable and sustainable. A perception of waste can send a wrong signal to the would-be beneficiaries. Intervention rationale should be appropriately communicated through the multimedia and interpersonal communication activities. Good intentions may be frustrated if portrayed in bad light. Interpersonal communication is fundamental in persuading people about specific beliefs and practices such as mothers' decisions to vaccinate their children, adopt hygiene practices, and keep communities clean. It is also important to incorporate approaches that focus on individual and environmental factors in understanding the role of behavior change communication. Changes in behavior and social conditions cannot be addressed only by targeting personal or contextual factors but, rather, need to be sensitive to both in order to understand problems and design solutions. This idea has been particularly relevant in behavior change programmes which have gradually moved away from individual-centered approaches to a multi-prong approach that considers environmental factors that are affecting individual behavior. Another issues is the sustainability of development projects. 'Sustainable development' features prominently on the agenda of donors and agencies, referring to development actions that out communities at the centre and have long-lasting impact. It is not the best if intervention projects show good results only as donors regularly inject funds. As Michael,(1999:83) in Waisbord,(2002) eloquently outs it, Wining short-term gains on the basic of heavy external inputs is not difficult, what is difficult is us them against the background of weak politics fragile economics, and limited capacities for implementation.

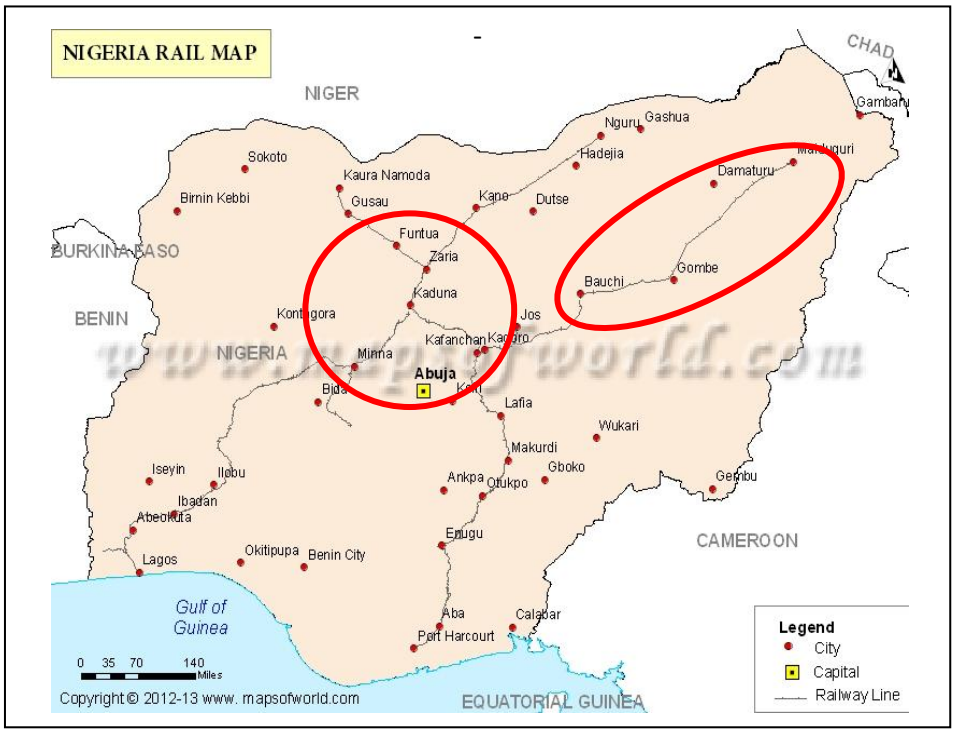


Fig. 2: Nigeria Rail Showing Kaura-Namoda (Gusau) Funtua, kaduna, Zaria Kano and Bauchi, Gombe, Damaturu, Maiduguri Railway Route.
Sources: www.mapsoftworld.com.

A Review of Railway Transportation System

This seems to have been strangulated due to lack of political will to implement its progressive policies for urban safety, convenience, security, aesthetics and wellbeing of the urban growth. The Town Planner referred to the rail network and trans-national highway planned reported that still being required by regional road transport programme to finish the work and that efforts were still on to rehabilitate the existing rail lines and interconnect their railway network as per established railway master plan for countries-latent intervention potentials requiring action.

Plate 4a: Gusau (Kaura-Namoda), Funtua, Zaria railway line
Source: Field Survey ,2015

Plate 4b: Bauchi - Maiduguri (Jere) railway line
Source: Field Survey, 2015

The challenges of infrastructure development in constitutional conference report 2014

The demand surpasses the supply and finance that will stimulate rapid provision is not there. Due to wide gap between provision and needs, the leadership classes are in arrears in all sectors. The political situation is not encouraging to foreign investors because the Dana air crash in june,2012 and the recent one at near Modibbo Adama University of Technology, Yola –Nigeria the difficulties

expressed in accessing the crash site are eloquent pointer to the need for planning, urban safety and security cannot be guaranteed without adequate monitoring of urban growth.

Plate 5: A Plane Crash Near Kabiru Umar Hostel at Mautech ,Yola –Nigeria 2014

Governments do not set the priority right in infrastructure development. Projects are supposed to meet objectives, but in most cases, projects embarked upon are white elephant projects. Good governance will be the only antidote that can bridge the wide gap. Secondly, good governance promotes accountability, reduces corruption and therefore minimises resource wastage through inefficiency. And finally, good governance ensures stability (economic and political) and reduces the level of risk associated with large and lumpy infrastructure investments. This in turn facilitates the mobilisation of both public and private sector financing resources that are critical for infrastructure development. The President of federal republic of Nigeria, Minister for economic, infrastructure, agriculture and the President of Nigerian Institute of Town Planners (NITP) and Town Planners Registration Council (TOPREC). Called for an institutional framework that will endure prioritization, harmonization and coherence in the implementation of programme for infrastructure development intervention in Africa

The Town Planner revealed that God is an intervener and that the Urban and Regional Planner is his imitator in the intervention process. If God has not intervened in the course of man's history. The Guinness book of records is adorned with names of people who intervened in their word be it in science, technology, medicine, arts or music. To be earth worthy is to influence the course of events for the better, after all, our goal in life should be to leave the stage better than we met it. That is real development. The essence of successfully crossing a stream is not to lay a historical claims but to tell our story so that all who would successfully navigate the stream will sail safe via the safe routes we have found. Such is the principle of intervention, lest others get lost when we ought to have shown them the way.

Ours is an intervening profession. We intervene to bridge gaps, correct imbalances, bring injustices and equity, boost livability and effectual sustainable development, growth and progress. We ultimately intervene to achieve the overall prosperity and happiness of all especially raising the under-privileged from miseries and woe. Whatever is at the back of the minds of those who advanced the push or pull factor, take off, backward integration and counterpart funding, intervention is readable therein and indeed and initial assumption that certain groups or

communities may linger longer than necessary in penury without intervention is the key to all these principles used in urban and regional planning. Although happiness rating cab change within a short time as we see between 2009 and 2012. Global Finance infrastructure development intervention is indispensable in this regard.

The metaphor of intervention being applied in our generation is becomes helpless, the man with life jacket waits for the helpless and drunken man. Sometimes he survives and at some other times he passes on. TOPREC, NITP and other intervening agencies will hopefully consider timeless as a factor in their intervention efforts before the drawing man dies. It is hoped that TOPREC council will encourage the conference committee, good governance, innovation, human capital development and personal freedom in its committee member and not wait for TOPREC to move in when the nation is already drawing. Conversely too, whereas, interveners mean for the ailing recipient communities, to carry the load of development to the head of the community is just assistance. If the recipient refuses to land the load on his head too bad.

There is no gainsaying the fact that we shall always have the poor infrastructures in and around us, it is however suicidal to overtly trust our lives to aids, donations, support, assistance and development from above. Such lazy and indolent disposition unnecessary increases the work of intervention agencies and deprives the meeting of genuine needs. Commitment to self-actualization should not be sacrificed on the altar in intervention advocacy. Intervention ought to address real needs.

Materials and Method

The method used for the analysis is descriptive statistical analysis of transportation features in selected local government areas: Gusau–Kaura Namoda in Zamfara State, Funtua in Katsina state, Bauchi-Gombe-Damaturu-Maiduguri railway route and Jimeta-Mayo-Belwa-Jada-Ganye-Toungo in Adamawa State. The study aims to examine the current condition, usage, and challenges of transportation infrastructure in these regions to inform policy, planning, and future development interventions.

Data Collection

Primary data were collected through field surveys, structured observations, and interviews with local residents and transport operators. Map or Satellite imagery and publicly available maps also supported the spatial assessment. Key variables include road condition, surface type, mode of transportation, usage intensity, and infrastructural challenges. The samples of study includes transportation features such as roads, public transport systems, terminals, water, rail and air transport facilities. is a representative snapshot of the data gathered.

Data Analysis and Presentation

Descriptive analysis was conducted to evaluate the status of transportation features. Most major roads are in fair condition but suffer from maintenance neglect. Feeder roads in rural areas are generally poor and become impassable during the rainy season. Bus terminals are inadequate and poorly equipped, while rail transport is inactive in the Gusau–Kaura Namoda corridor. Yola Airport remains operational but suffers from limited public transport connections. Water transport, though present in the riverine area, it is seasonal, poorly developed, and lack of formal docking infrastructure or safety oversight.

Table 1. Distributions of Transport Feature, Location, Condition, Types, Usage and Challenges

Feature Type	Location	Condition	Type	Usage	Challenges
Major Road	Gusau– Funtua	Fair	Asphalt	High	Potholes, erosion
Feeder Road	Mayo-Belwa wards	Poor	Earth	Low	Seasonal flooding

Parking Area	Jada Market	Poor	N/A	High	Road encroachment
Rail Line	Gusau–Kaura-Namoda	Non-active	Rail track	None	Abandoned infrastructure
Airport	Yola	Good	Paved	Moderate	Poor access road
Water	Riverine Area	Seasonal	Water	Low	Moderate &Limited boats

Source; Field Survey,2015

Summary of Findings

1. Major roads are inconsistently maintained, with surface deterioration affecting traffic flow.
2. Feeder roads are largely earth surfaced, lacking durability and reliability, particularly in rainy seasons.
3. Informal public transport is widely used but lacks regulatory oversight and safety controls.
4. Bus terminals are few and inadequately equipped, contributing to congestion and commuter discomfort.
5. Rail transport infrastructure exists but is inactive and deteriorating due to neglect.
6. Yola Airport functions but lacks reliable public transit access.
7. Parking is mostly informal, contributing to obstruction and reduced road efficiency.
8. Water transport, exist in riverine area, it is underdeveloped and insufficiently maintained. informal systems predominate, with critical gaps in safety.

Conclusion

The transport network in the study areas is underdeveloped and insufficiently maintained. Informal systems predominate, with critical gaps in safety, regulation, and infrastructure. The lack of integrated transport planning has resulted in inefficiencies, particularly affecting rural and low-income populations. Water based transport remains underutilized and unintegrated despite its potential improving access in riverine communities.

Emerging, General Issues and Decisions of the Conference

All the Nigerian transport sectors and investments need to be subject to careful analysis to ensure that the benefits, net of the costs, meets appropriate investment criteria and represent value for money; while policies and plans are practical and sustainable.

General Resolutions on Transportation By Conference

Enactment of a new Transportation Legislation

Conference decided as follows:

1. Review the existing legislation by including all States and the private sector in the provision of transport services provided such participation is subject to the policies and guidelines of the National Transport Commission This will allow the development of transportation infrastructure to be inclusive of rights of State governments to build intra-state transport infrastructure as well as encourage private investors to build and operate rail, ports and road infrastructure and invest in critical sectors like mines, beneficiation plants and integrated agriculture projects; and
2. For effective and efficient transportation system, through healthy competition and specialization for agricultural, navigational, security, social services and general economic wellbeing of the citizens; it is recommended that the sector (Railway, Port, Land, Water, Sea and Air) be listed under the Concurrent Legislative List that will spell out the areas of legislative competence of both the Federal and State Governments Federal Republic of Nigeria, National Constitutional Conference Report,(2014).

The paper has revealed that there are positive and negative impacts especially in the environmental aspects and has called for a balance between the economic and environmental benefits of the transportation sector in the years to come imply that relevant planning and conservation principles

should be in place to derive more environmental and socio-economic benefits from the transportation system.

Recommendations

Looking forward to sustainable development prosperity and happiness in the constitutional conference report, the following have been considered as needful. Based on the findings of this study, recommendations are hereby suggested to enhance the positive environmental and socio-economic impacts of the transportation system.

i. A committed ***to human development*** through improved intervention on physical and social infrastructure. The Ten-Year Ten Sector Intervention Proposal (TYTSIP) provides a basic for such intervention efforts aimed at boosting prosperity and happiness ranking Nigeria culminating in better.
ii. A commitment ***to local raw materials utilization and development*** for building, construction and infrastructure provision with the ultimate use of local experts for strategic infrastructural development will boost the prosperity ranking of the region
iii. Actualization of the ***principle of integration and intervention*** among the constitutional conference committee members in key sectors like transport, energy, health, education and ICT alongside with the machinery to ensure that States contribute their quotas to the purse of transportation regulations and abide by the constitutional committees' decisions is essential to successful supranationally.
iv. The problems associated with intervention projects has already identified in this paper can only be addressed by the use of **appropriate and transparent intervention processes** beginning with generating the ideas for intervention from below while also carrying the beneficiaries along in case intervention ideas are from the top.
v. The Town Planner's Registration Council (TOPREC) and the Nigeria Institute of Town Planner's (NITP) will be integrated, incorporated, and intervene in Transportation Master Planning document of constitutional conference report which may be passed into law to prevent the abuse of the planning profession globally.
vi. Rehabilitate and maintain major and feeder roads with drainage infrastructure.
vii. Formalize public transport services with structured routes and fare regulations.
viii. Revitalize dormant rail lines in Gusau–Kaura Namoda, Funtua, Kaduna, Zaria and Kano for cargo and passenger service.
ix. Improve road access and shuttle services to Yola Airport.
x. Adopt GIS-based planning tools for transportation infrastructure monitoring and development.
xi. Conduct periodic transport needs assessments to inform policy and investment.
xii. Develop water transport infrastructure in riverine area, including docks, boats, and safety regulation frameworks

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TEACHER PROFICIENCY IN THE APPLICATION OF MULTIMEDIA IN EARLY CHILDHOOD EDUCATION OF NCE AWARDING INSTITUTIONS IN PLATEAU AND NASARAWA STATES

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Abstract
This study was on teacher proficiency in the application of multimedia in early childhood education in NCE awarding institutions in Plateau and Nasarawa States, Nigeria. The objectives were to determine the Multimedia Based Learning Instructions (MULBLI) facilities, determine the level of teacher proficiency in MULBLI and identify the impediments to the effective Deployment of MULBLI in the study area. The study was carried out in the Early Childhood Education departments of the NCE awarding institutions in Plateau and Nasarawa States. The total of 250 questionnaires was administered to relevant teaching staff in ECE departments, and a total of 219 were received and used in the analyses after putting off incomplete ones. The general response rate after data screening was 87.6 percent. Descriptive statistics based on mean ranking was used to determine the results. Research question 1 was on the level of MULBLI facilities, and the major level is Computer Equipment/Printers, while the least level was reported in Closed circuit television (CCTV) and Cable satellite facilities respectively. Question 2 was to determine the level of teacher proficiency in the application of MULBLI. The results indicated the highest ranked as Computer Equipment/Printers, while the lowest are Loudspeaker/Amplifiers/Microphone, Editing/dubbing machine, Floodlights, Closed Circuit Television (CCTV) and Cable satellite facilities respectively. Question 3 was on the impediments in the deployment of MULBLI. Inadequate multimedia facilities ranked high, lack of multimedia instructional applications, inadequate electricity supply, and lack of training among others ranked moderate. The findings show a high level of MUBLI facilities, high level of teacher proficiency in MUBLI and a moderate level of impediments in the deployment of MUBLI in the study area. Recommendations were made on how to enhance teacher proficiency as well as the deployment of multimedia facilities for effective teaching and learning.

Keywords: Multimedia, Education, Early Childhood Education, Teacher, Technology

Introduction

Multimedia is described as the combined use of sound, video and text to present an idea. (Run, 2020). He added that it is the use of different media to convey information. Ghoshal (2016) sees multimedia as something relating to an application, especially a computer that can combine such media into an integrated package. Baharul et al, (2014) asserts that multimedia combines hard and soft wares to make an idea or concept visible and audible. It is also the use of graphic gadgets and applications in facilitating ideas. In like manner, multimedia is a form of communication that uses a combination of different content forms, such as video footage, audio and still images.

Multimedia-based learning instruction (MULBLI) is a teaching and learning method which response to the children's actions by presenting contents such as texts, graphics, animation, video, audio etc. Multimedia has provided alternative from the traditional teaching/learning situation to more interactive methods by affording both teachers and pupils with interesting contents through the effective use of technology, (Yezerski & Birk, 2016). Learning environment is the big factor to adapt pupils with their learning system. Multimedia based learning instruction can help to create high quality learning environments especially for children through different media like texts, graphics, sound, video, animation etc. Obed and Linder, (2015) assert that traditional education is slowly moving away from pen-and-paper correspondence courses to a more interactive, integrated learning environment.

Multimedia based learning instruction has recently gained considerable attention, as particular forms of teaching with technology. Run, 2020 opined that "If someone is learning in a way that uses information and communication technologies, they are using multimedia learning. They could be a pre-school child playing an interactive game; or a group of pupils collaborating on a project with pupils in another country via the internet – it all counts as multimedia based learning instruction". Actually, due to the rudimental nature of the traditional learning method a new approach using technology known as multimedia based learning instruction (MULBLI) is apt. Its importance cannot be over-emphasised, as it provides direct approach to learning. Children assimilate this method of learning very easily and fast because it is entertaining and captivating and enhances and motivates children towards learning, (Yezerski & Birk, 2016).

Multimedia based learning instructions may be used to replace the traditional method of teaching with additional readings, electronic instructor notes and images of charts, graphs, or other handouts in one course. Indeed, teaching is the passion and relationship between the teacher and the student. Technology is seen as being possibly useful in supporting face-to-face teaching, enabling pupils to interact with learning materials.

Statement of the Problem

The poor working environments due to lack of modern teaching facilities has negatively affected instructions especially on children resulting in very minimal outcomes. Some of these outcomes are teachers' inability to teach the children well, and also, the children's lack of understanding in the classroom especially of complex concepts and methods.

Lack of qualified teachers with relevant skills in digital technology, like multimedia tools in handling modern teaching facilities is also a thing of concern in the teaching – learning situation. Although, many teachers may have certain artistic skills, they do not effectively master the use of multimedia tools, gadgets, and software applications.

Impediments to the effective deployment of technology in teaching and learning abound in the classroom. Today, emphasis is shifting away from time consuming and regimental approach of instructions towards a more captivating and entertaining methods of sustaining attention, as children quickly assimilate through entertainment. For example, the scheduled contact hours may not be adequate to accommodate the curriculum designed for annual academic activities. Run, (2020) observed that these make the classroom situation static and dull without life.

Aim and objectives

The aim of this study was to assess the teacher proficiency in the application of Multimedia Based Learning Instructions (MULBLI) in early childhood departments of NCE awarding institutions Plateau and Nasarawa State, North-Central Nigeria.

The objectives of the study are to;

i. identify the level of Multimedia Based Learning Instructions (MULBLI) facilities provided in early childhood departments of the NCE awarding institutions Plateau and Nasarawa States.
ii. determine the level of teacher proficiency in the application of MULBLI facilities in the study area.
iii. identify the impediments to the effective deployment of MULBLI in the study area.

Research questions

i. What is the level of Multimedia Learning Instructions (MULBLI) facilities provided in the Early Childhood Departments in the NCE awarding Institutions in Plateau and Nasarawa States?
ii. What is the level of teacher proficiency in the application of MULBLI facilities in the study area?
iii. What are the impediments to the effective deployment of MULBLI in the study area?

Scope of the study

The study covered the NCE awarding institutions in Plateau and Nasarawa States, North-Central Nigeria offering early child education programmes. These are Plateau State College of Education Gindiri, Federal College of Education Pankshin and Jos ECWA Seminary, Jos. Others are Nasarawa State College of Education, Akwanga and Hill College of Education Gwanje. The study focused on multimedia facilities, teacher proficiency in the application of, MULBLI and impediments to the effective deployment of MULBLI in teaching and learning. The respondents to the research instruments were the relevant teachers in the early childhood education departments of the institutions mentioned above.

Concept of Early Childhood Education (ECE)

Early Childhood Education is a term that refers to educational programmes and strategies geared toward children from birth to the age of eight, (Alexander, 2016). This period is widely considered the most vulnerable and crucial stage of a person's life. Early childhood education often focuses on guiding children to learn through play. The term commonly refers to preschool or infant/childcare programmes. Early childhood has been defined as a period of life between 3 to 8 years of age. This is the period of greatest growth and development, when the brain develops most rapidly, almost at its fullest, (*Kroll,* 2021). It is a period when walking, talking, self-esteem, vision of the world and moral foundations are established.

It is generally believed that the child's early years constitute the period of most rapid and permanent learning. By age four, about 50 % of intellectual development potential of the child is already in place, (Baharul et al, 2014). Enhancing the quality of young children's lives is now a national and international priority, expressed through research and policy initiatives, programme development and advocacy. This therefore may explain the increasing global attention being giving to early childhood education. According to the National Policy on Education, 2024 given to a child in an educational institution prior to his entering primary school (NPE, 2024). This level includes the crèche, the nursery, and the kindergarten. This can also be called pre-primary education programme. Gero et al, (2014) stated that the years between birth and age five are the foundation upon which successful (or otherwise) lives are built.

Obed and Linder, (2015) affirms that the first five years is critical for a child's overall development and later life chances. Alexander, (2016) asserted that ECE is the term commonly used to describe

the formal teaching and care of young children by people other than their families or in settings outside of the home. Early childhood and education span the human life from birth to age eight. However, early childhood and education covers the period from birth to when a child starts school. Early Childhood Education, according to *Kroll, (*2021) is actually the first part of basic education and must be given priority and accorded appropriate workforce for effective service delivery. Busch (2017) posits that early childhood education (ECE) refers to a wide range of programmes, all aimed at the physical, cognitive and social development of children before they enter primary school, theoretically from birth to age 7 or 8years. Obed, and Linder, (2015) defined early childhood education as that which is designed to develop the habits, attitudes and skills needed for primary education, while Gero et al, (2014) maintain that the concept of early childhood education only covers the practice of early childhood education and learning of the child. Similarly, Hujala and Heikka, (2020) posits that early childhood education in Finland deals with the process of Care, Education and Teaching of the child to ensure that he or she effectively acquires basic skills to cope with the primary stage of schooling. UNESCO and UNICEF, (2012) further define the term early childhood education (ECE) as a range of processes and mechanisms that sustain, support and aid the holistic development of children, from birth to age 8.

Due to the rapid neural connections in brain development and growth that take place at this age bracket, the period is considered a critical window of opportunities for optimising children's development through the combined impact of education, care, health, nutrition, protection and stimulation. This also includes the support of family and community needed to promote children's healthy development. (Dalglish, Khalid, & McMahon, 2020) affirms that the early years are formative of children's long-term prospects. Children's physical growth is also very rapid during the early years, but physical maturation is a much more extended process compared with the changes taking place within the nervous system, (Chung & Krajcik, 2015). The earliest months of life are also the period of most rapid synapse formation constructing the dense networks of neural connectivity on which cortical activity depends.

Research into early brain development is significant in drawing attention to the pre-natal period and the very earliest months and years of life, and emphasising the crucial importance of adequate nutrition, responsive care and a supportive environment at a time of successive qualitative shifts in development. While early childhood policy development tends to give priority to the pre-primary years, evidence from developmental neuroscience argues for a more comprehensive early childhood education strategy, encompassing the welfare of children and families before birth. It appears that optimal human development can be achieved through a wide range of family setting, childcare practices and pedagogic approaches in the children's' world, (UNICEF, 2011). ".before many adults even realise what is happening, the brain cells of a new infant proliferate, synapses crackle and the patterns of a lifetime are established, choices made, and action taken on behalf of children during this critical period affect not only how a child develops but also how a country progresses."

Early Childhood Education summarily is seen as the first formal form of education given to children between the ages of 1 to 5years and learning is usually through play by the use of toys and games.
Early Childhood Education emerged as a field of study during the era of educational enlightenment in the eighteenth century, particularly in European countries with high literacy rates. It continued to grow through the nineteenth century as universal primary education became a norm in the Western world. Kwame, (2015) noted that in recent years, early childhood education has become a widespread public policy issue, as funding for preschool and pre-K is debated by municipal, states, and federal lawmakers of many European countries. Governing entities are also debating the central focus of early childhood education with focus on developmentally appropriate play versus strong academic preparation curriculum in reading, writing, and math, (Hanushek & Woessmann, 2015). The global priority placed on early childhood education is underscored with targets of the United Nations Sustainable Development Goal 4. As of 2023, however, "only around 4 in 10 children aged 3 and 4 attend early childhood education" around the world. Furthermore, levels of participation vary widely by region with, "around 2 in 3 children in Latin American and the Caribbean attending ECE

compared to just under half of children in South Asia and only 1 in 4 in sub-Saharan Africa" (Dalglish, Khalid, & McMahon, 2020).

Early Childhood Education is also a professional designation earned through a post-secondary education programme. For example, in Ontario, Canada, the designations ECE (Early Childhood Educator) and RECE (Registered Early Childhood Educator) may only be used by registered members of the College of Early Childhood Educators, which is made up of accredited child care professionals who are held accountable to the College's standards of practice. Research shows that early-childhood education has substantial positive short- and long-term effects on the children who attend such education, and that the costs are dwarfed by societal gains of the education programmes. There are numerous exponents who contributed immensely in the foundation and development of early childhood education; For example, early childhood education can be traced to the efforts of prominent European education experts like: John Amos Comenius (1590-1690), J. J. Rousseau (1782 – 1788), Johann Heinrich Pestalozzi (1748-1827) and Friedrich Froebel (1782-1751). These experts championed the right of children to early education. It is popularly believed that Friedrich Froebel who has been given a great deal of credit for his contributions to early childhood education is the founder of kindergarten. His beliefs is in how young children should be educated also impact today's classroom, *(Marope, & Kaga, 2015).*

Method of Data Analysis: The data collected was analysed using Statistical Package for Social Sciences (SPSS).

Field survey results

The totals of 250 units of questionnaires were administered to relevant teaching staff of early child education departments in the NCE awarding institutions of Plateau and Nasarawa States of Nigeria. The 250 teaching staff are both the lecturers teaching the NCE undergraduates and the teachers teaching the pupils at the early childhood units in the ECE departments of the institutions. Also, the number was chosen to cover all the teaching staff in the ECE departments because they are not many. A total number of two hundred and twenty-seven (227) questionnaires with a 90.08 % response were retrieved. A total of 219 were used in the analyses after putting off incomplete ones. The general response rate after data screening was 87.6%.

Reliability Results

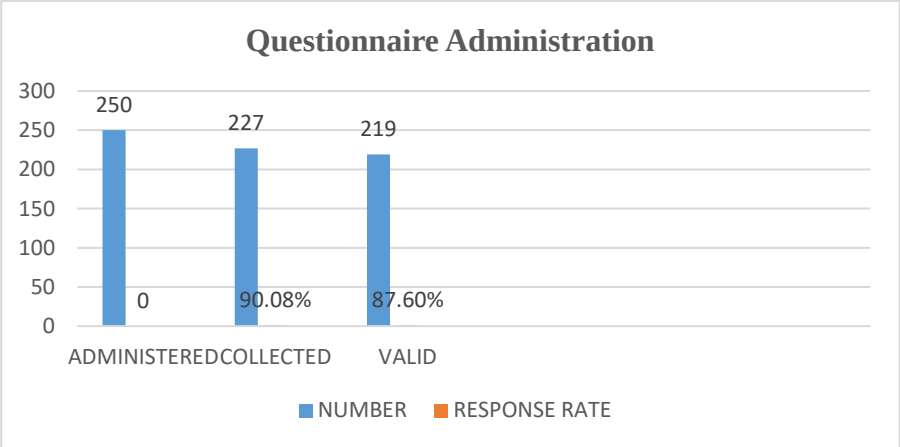

Fig. 1 Number and percentage of questionnaires administered

The reliability of the constructs was analysed by finding Cronbach's alpha as recommended by Pallant (2011). The reliability test for the field records confirmed that the Cronbach's alphas acquired for each of the constructs are above the minimum recommended of 0.7 in Pallant (2011).
A normality test was done in the examination to meet the presumption of regression and correlation proposed by Pallant, (2001). Figure 3 shows the Kurtosis with the highest value of 1.990 and

Skewness with the lowest value of -.002, indicating that the results were within the acceptable range of +/ - 2 as suggested in George and Mallery (2010).

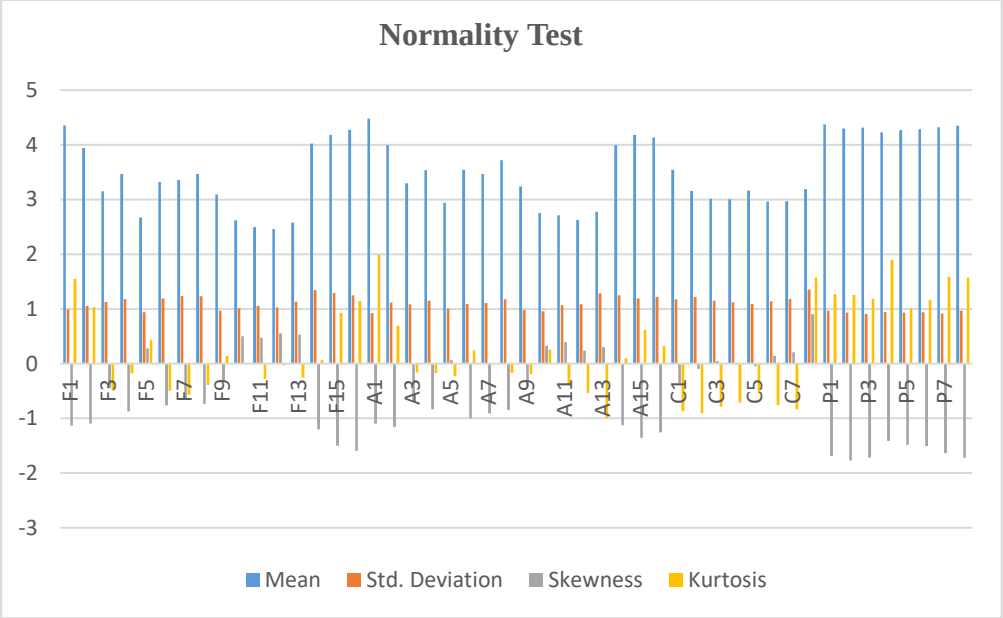

Fig. 2 Mean and Standard Deviation of Normality Test

The results showed that majority of the respondents were within the age of 30 to 60 years with a higher percentage of 66.2%. Concerning educational qualification, most of them have the first degree which indicated a higher percentage of 42.0%. Also, concerning the years of experience, most of them have experience of 5 to 10 years with a percentage of 54.8%.

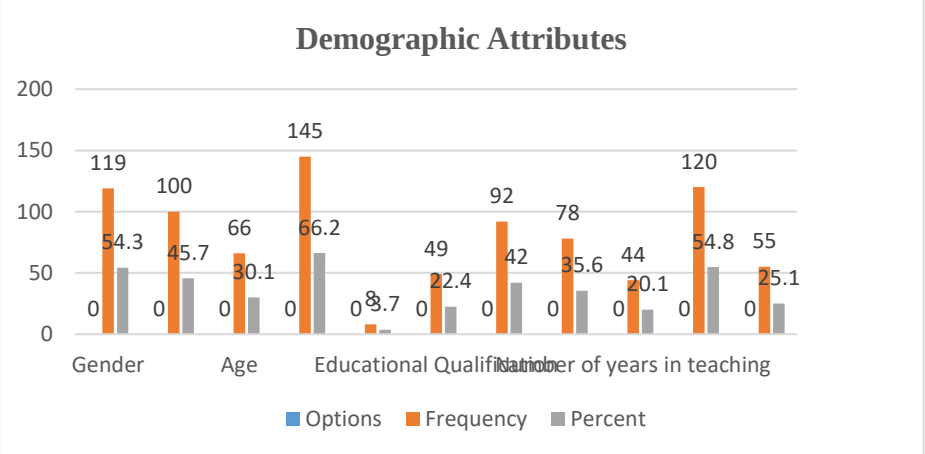

Fig. 3 Frequency and Percentage of Respondents

Decision Rule

A 5-point Likert scale was employed, with distinct variables having comparable or different scale descriptions. Despite the description differences, the concept has a uniform mean ranking scale. As a result, the ranks were numbered from one (1) to five (5), with one (1) being the lowest and five (5) being the highest. Based on the work of Ramli et al (2017), this study altered the mean score decision interval from which the following interval decisions were deduced. (1-1.80) = Very low (1.81-2.60) = Low (2.61-3.40) = Moderate (3.41-4.20) = High (4.21-5.0) Very high.

Descriptive statistics based on mean ranking were carried out to identify the level of MULBLI facilities provided, teacher proficiency in the application of MULBLI as well as the impediments in the deployment of MULBLI in the NCE awarding institutions in Plateau and Nasarawa States. Hence, the results showed the ranking, mean, and standard deviation for each item in figures 5 , fi 6 and 7 below.

Data Presentation and Analysis

Research question 1: The level of MULBLI facilities provided in the ECE Departments of the NCE awarding institutions in Plateau and Nasarawa States, Nigeria.

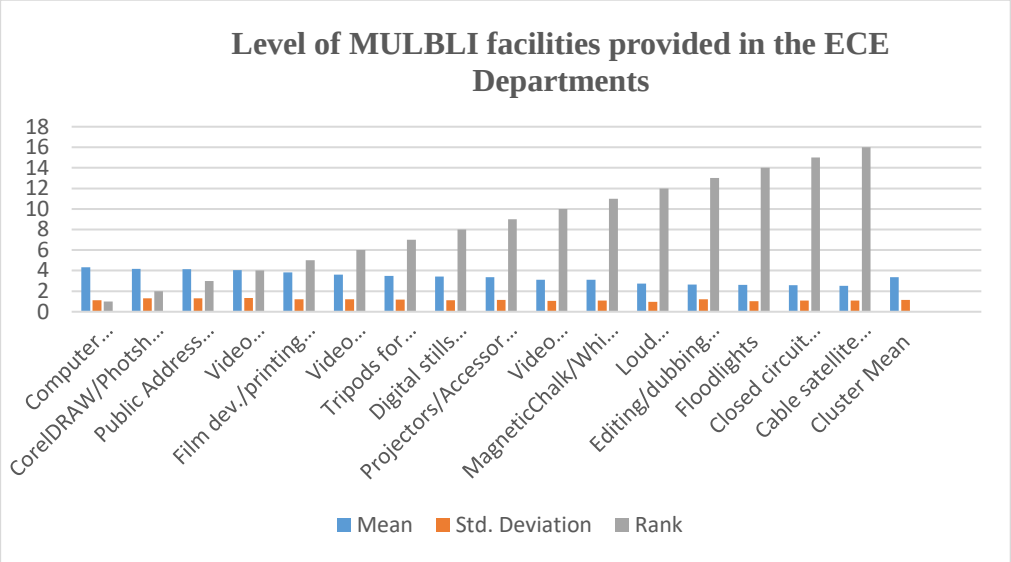

Fig. 4 Level of MULBLI facilities provided in the ECE Departments

The figure 4 above showed the results of the level of MULBLI facilities provided in the ECE Departments of the NCE awarding institutions of learning in Plateau and Nasarawa States, Nigeria. The major level of MULBLI readiness of the institutions in the study area was in Computer Equipment/Printers, with the highest mean value of (M = 4.3149, std. deviation = 1.12263) ranked first as Very high, followed by CorelDraw/Photoshop, Public Address System/Accessories and Video player/recorder with their high mean value of (M = 4.1721, std. deviation = 1.31443), (M = 4.1295, std. deviation = 1.31748) and (M = 4.0548, std. deviation = 1.32952) ranked High at 2nd to 4th respectively. The moderate level of MUBLI readiness was reported in Film development/printing equipment, Video Camera/Accessories, and Tripods for Video/Still Cameras, with means of (M = 2.7245, std. deviation = .95956), (M = 2.6362, std. deviation = 1.22692), and (M = 2.6239, std. deviation = 1.02360). The least level was reported in Closed-circuit television (CCTV) and Cable satellite facilities with their Low mean values of (M = 2.5952, std. deviation = 1.09565) and (M = 2.5327, std. deviation = 1.07219) ranked at 15th to 16th, respectively.

Research question 2: The level of teacher proficiency the application of MULBLI in the in the ECE Departments of the NCE awarding institutions of learning in Plateau and Nasarawa States.

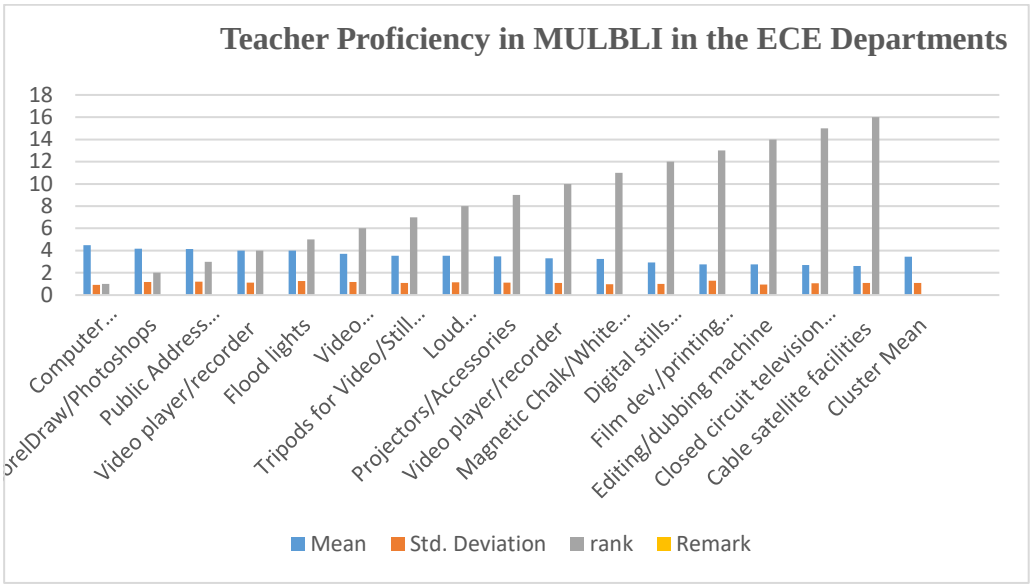

Fig. 5 Level of Staff Proficiency with MULBLI in the ECE Departments

Figure 5 above present the results of staff proficiency in the application of MULBLI in the study area. The results indicated the major level of staff proficiency in MULBLI in the study area were in Computer Centre, ranked very high with a mean value of (M = 4.4815, std. deviation = .92351). Computer Equipment/Printers and CorelDRAW/Photoshops with their mean values of (M = 4.1822, std. deviation = 1.18842), and (M = 4.1368, std. deviation = 1.21729) were ranked high at 2nd and 3rd respectively. The lowest teacher proficiency in MULBLI in the study area were in Digital stills camera/Accessories, Film development./printing equipment, Editing/dubbing machine, Closed circuit television (CCTV) and Cable satellite facilities with their mean values of (M = 2.9429, std. deviation = 1.00301), (M = 2.7746, std. deviation = 1.28360), (M = 2.7547, std. deviation = .95602), (M = 2.7136, std. deviation = 1.06558) and (M = 2.6238, std. deviation = 1.08636) ranked at 12st to 16rd respectively.

Research question 3: The impediments to the effective deployment of MULBLI in the ECE Departments of the NCE awarding institutions of learning in Plateau and Nasarawa States.

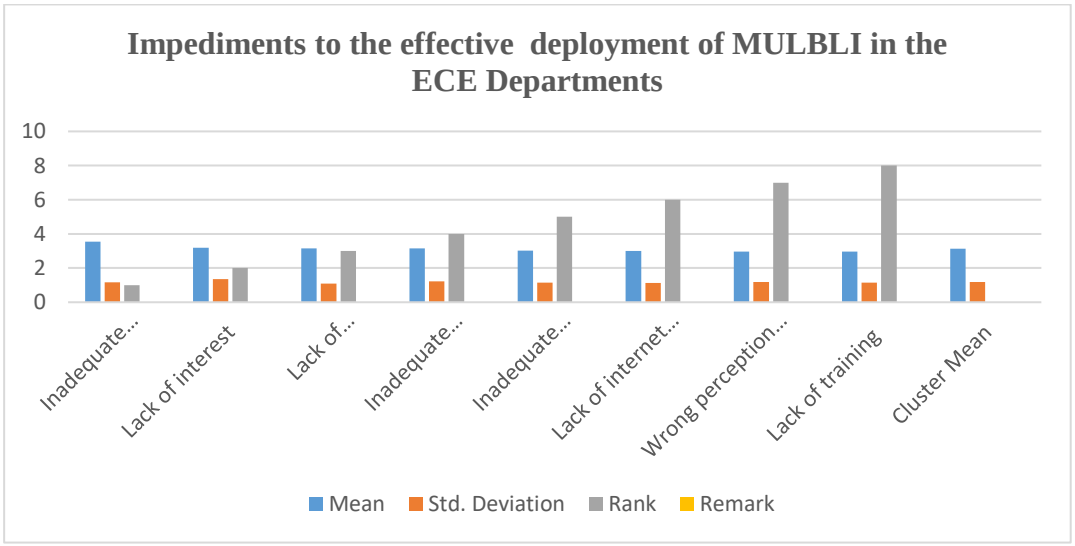

Fig. 6 Impediments to the effective deployments of MULBLI in the ECE Departments

Figure 6 above showed the results of impediments encountered in the deployment of MULBLI in the NCE awarding institutions in Plateau and Nasarawa States. The results indicated the major impediments encountered in the deployment of MULBLI in the study area is inadequate multimedia

facilities, ranked first and highest with a mean value of (M = 3.5459, std. deviation = 1.17175). Lack of interest and lack of multimedia instructional applications with their mean values of (M = 3.1905, std. deviation = 1.35522), and (M = 3.1602, std. deviation = 1.09149) were ranked at 2nd and 3rd respectively. The least impediments experienced in the application of MULBLI in the study area were Wrong perception and attitude and Lack of training with their mean values of (M = 2.9714, std. deviation = 1.17666), (M = 2.9665, std. deviation = 1.13890), ranked at 7th and 8th respectively.

Major Findings/Discussion

In this discussion, the research questions which guided the study were examined individually in the light of the major findings and published data.

What is the level of MUBLI facilities provided in Early Childhood Education (ECE) Departments of the NCE awarding institutions in the study area?

Based on the findings on question one above, general mean ranking shows 3.36 which is high, implying that the ECE departments in the study area have adequate MUBLI facilities. The finding reveals that most of the multimedia items are provided in most of the ECE departments in the study area, except for few items who ranked low. This finding agrees with Chinelo and Ayodeji, 2016, in their study on the effects of multimedia on primary pupils' academic performance and attitude in English Studies in Lagos State, Nigeria. They reported that most of the schools in their study area have sufficient supply of most multimedia facilities. Also, in their findings, it was reported that the use of multimedia in teaching and learning was of great advantage to the pupils as it avails them with modern instructional applications. This study however differs from the findings of Genc and Sahin (2020) in their study: Multimedia facilities in secondary schools: the Borno State experience. It was revealed that most of the schools do not have adequate multimedia facilities for instructions. This was because the multimedia facilities were generally not there or not provided, probably because the study was conducted at the heat of Boko haram insurgency where budgetary attention of the then Borno State government was not adequately given to education, or probably most of the facilities provided were destroyed or stolen because people were chased away from their inhabitants thereby abandoning their schools.

What is the level of teacher proficiency in the application of MULBLI in the ECE Departments in the study area?

The general mean ranking is 4.627 meaning that the level of staff proficiency in the application of MULBLI in the ECE departments in the study area is very high. This reveals that the teachers of the ECE departments in the study area are very knowledgeable in handling multimedia facilities and applications for instructions. The finding is in line with that of Falola and Jolayemi (2020). They studied: Impact of Multimedia Technology on the Teaching and Learning of Oral English in Osun State Secondary Schools, Nigeria. They reported that the teachers in Osun State are very familiar with and have been using technology for a long time since the transition from traditional teaching methods to modern methods has commenced. This has enhanced the teaching and learning of oral English in the State. They added that, the government of the state has been given premium to education in the State due to the sustainable increase in the education budget over the years. This became more interesting considering Patel's (2013), observation that the new era has assigned new challenges to modern teachers and that the use of multimedia technology in teaching has made it more interesting and productive. Gilakjani (2017), Ahmadi (2018) and Falola, and Jolayemi (2012), corroborate Chirag's views by noting that teaching has changed due to technology thereby becoming more interesting.

What are the impediments to the effective deployment of MULBLI in the ECE Departments in the study area?

Based on the overall mean ranking of 3.12, the challenges to the effective deployment of MULBLI in the NCE awarding institutions of learning in the study area were moderate. This means that most of the variables that may constitute hindrances to the smooth teaching and learning situation in the ECE departments have been moderately taken care of. This finding is however, in aberrance with

that of Abdulrahaman et al, (2020), their findings were contrary. They reported in their work: Multimedia tools in the teaching and learning processes: A systematic review, that most of the institutions with ECE departments in their study areas (Osun State) do not have adequate multimedia facilities and applications. They reported that attitudes and beliefs towards the use of technology in education, lack of teachers' confidence and resistance to change, lack of basic knowledge and ICT and multimedia skills, lack of technical, administrative and financial supports, lack of physical environment are some of the barriers identified in the various articles reviewed. These barriers affect the integration of multimedia in education.

Also, Muhammad et al, (2019) in their study titled: Factors militating against the use of multimedia/ICT in teaching and learning in public secondary schools in Kebbi State, Nigeria reported contrary to this study. They revealed that majority of the respondents within the selected schools said they do not have internet facilities in their schools. They added that most of their teachers do not use multimedia/ICT resources in their teachings. This was probably due to lack of electricity, internet facilities, lack of training of teachers and general look warm attitude of Kebbi State government towards public education. The above findings are supported in the existing literature as reported by Kurawa (2008), that inadequate material resources posed a serious challenge to science teachers because most of the schools are poorly equipped. In such a condition, teaching impedes knowledge and less development of the skills by the students.

Recommendations

The findings in the course of this study generally revealed positive outcomes based on the responses. There is however some areas that need adjustments that can help improve the teacher proficiency in the deployment of MULBLI to enhance the learning outcome and experience for children. It is therefore recommended that: government, institutions and well-meaning individuals should:

i. provide training and retraining for teachers on how to use these facilities effectively. The training can be through workshops, seminars, and online courses.
ii. create a culture of innovation and creativity that encourage teachers to use multimedia facilities in their teaching, and to share ideas and collaborations on projects create incentives for staff to improve their proficiency with animation by offering financial rewards, promotion opportunities, or other recognitions.
iii. address the issue of inadequate multimedia facilities.
iv. monitor the impact of their efforts to improve the deployment of MULBLI. This will help them to identify areas where further improvement is needed.

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MAPPING OF CONFINED AQUIFERS FOR MANUAL DRILLING IN HONG LOCAL GOVERNMENT AREA OF ADAMAWA STATE USING PROBABILITY KRIGING

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Abstract
Manual drilling offers a practical and affordable method of increasing access to groundwater supply in regions struggling with economic water scarcity. There were a lot of drilling activities that were carried out to find ground water in Hong Local Government Area of Adamawa State, but the results are not always positive, that is, sometimes drillers are not successful. Some of the areas with boreholes or wells use to experience drawdown during the dry season. This problem has led to high cost incurred for drilling activities, this can however, be due to poor knowledge of the geology of the area. Probability kriging is proposed as an interpolation method that builds upon previous efforts to identify suitable zones for manual drilling, particularly in weathered basement aquifers. This study focused on mapping confined aquifer for manual drilling using Probability Kriging. The studies produced map that show areas of confined and unconfined aquifer, the suitable areas for manual drilling are the confined aquifers. Places like Dzuma, kwakwa, ShuwaKala'a, Zum, ShuwaKala'a, Makera partly Mararaban Mubi and Gashala are more and has the potential for manual drilling. The results of the Kriging for the best model and suitable locations for manual drilling are produced and presented in the form of probability map using probability kriging interpolation. This study has improved the ability to understand the hydrogeology of the study area and recommended that further research should be conducted to assess the performance of probability kriging with other non-parametric Kriging methods in identifying suitable sites for manual drilling.

Keywords: Probability Kriging, Mean Error, Root Mean Squared Error, Mean Standadised Error, Root Mean Square Standard Error, Average Standard Error

Introduction

Manual drilling is a practical and affordable solution for wells less than 40 meters deep in alluvial soils such as clay and sand and soft weathered rock formations such as soft sandstone and limestone (Robert, 2010). There are many areas around the world where it can effectively provide water for drinking and for irrigation to un-served rural populations at a fraction of the cost of conventional drilling. Over the last 20 years, Nigeria has become increasingly dependent on groundwater, which is now estimated to provide drinking water for over 100 million people (from hand dug wells, boreholes/tube-wells and springs). Nigeria is witnessing a process whereby manual drilling (mainly jetting) for domestic water supplies is becoming a main-stream and accepted approach in the feasible areas of at least 25 of Nigeria's 36 states (Kerstin 2015). According to West and Sinha (2019), aquifers are underground layers of water-bearing rocks or sediments that collect and transport groundwater. These aquifers must be identified and characterized in order to ensure sustainable groundwater management. Aquifer depth, resistivity, and thickness are important factors for groundwater exploration because they determine the quality and amount of available groundwater resources (Shishaye 2016).

Amechi et. al. (2022), identifying the regional distribution of these factors is critical for efficient groundwater extraction and long-term conservation. Philip and David (2020) utilised Indicator Kriging to identify suitable zones for manual drilling in weathered crystalline basement aquifers. Robin et al (2021) applied Indicator Kriging to hydraulic head data to test alternative conceptual models for spring source aquifers and explained that the techniques Indicator Kriging can inform conceptual model uncertainties arising from the interpretation of sparsely distributed hydraulic head datasets, a major benefit over traditional interpolation methods. Partha and Jyotiprava (2017) Compared deterministic and stochastic methods to predict spatial variation of groundwater depth, among the kriging methods, UK performed better than OK to predict water table depth. Kalid et al (2024) assessed the optimal interpolation approach to groundwater depth estimation, the results demonstrated the superiority of the Radial Basis Functions (RBF) method, exhibiting the lowest RMSE, MAE, and the highest R^2 compared to IDW and OK. Khairul *et al.* (2021) studied groundwater table variability and trend using ordinary kriging: in Sylhet, Bangladesh and Kriging gave more accurate results in mapping the groundwater level across the study area.

Statement of Problem

There were a lot of drilling activities that were carried out to find ground water, but the results are not always positive, that is, sometimes drillings are not successful. Some of the areas with boreholes or wells use to experience drawdown during the dry season. This problem has led to high cost incurred for drilling activities, this can however, be due to poor knowledge of the geology of the area. Hence, the need for scientific identification aquifer that are confined for resources exploration, exploitation and management.

Aim of the Study

This research identified and map confined aquifers of Hong Local Government Area (LGA) through the following objectives.

Objectives of the Study

I. Estimate aquifer depth and thickness using vertical electrical sounding.
II. Estimate aquifer depth and thickness of the aquifer using stochastic interpolation technique and perform model cross validation (comparison) and obtaining the best model.
III. Use the best fit estimation models for aquifer depths and thicknesses to produce the confined aquifer map of the study area.

Materials and Methods

Study Area

Hong Local Government Area (Figure 1.1) is located in Adamawa state Nigeria; it was created in 1987 with Hong town as the administrative headquarter. It is located on latitude 9^0 58' to 10^0 35'N and longitude 12^0 35' to 13^0 13' E. It has a land area of 2,662 Km^2 (Gundiri, 2024). The population of Hong Local Government Area from an exponential projection of 2016 to 2018, the study area has a population of 239,602. It borders Borno state to the North, Gombi Local Government Area to the West, Song Local Government Area to the South, Maiha Local Government Area to the Southeast and Mubi North and South Local Government Areas and Mubi to the East (Zemba *et al* 2020).

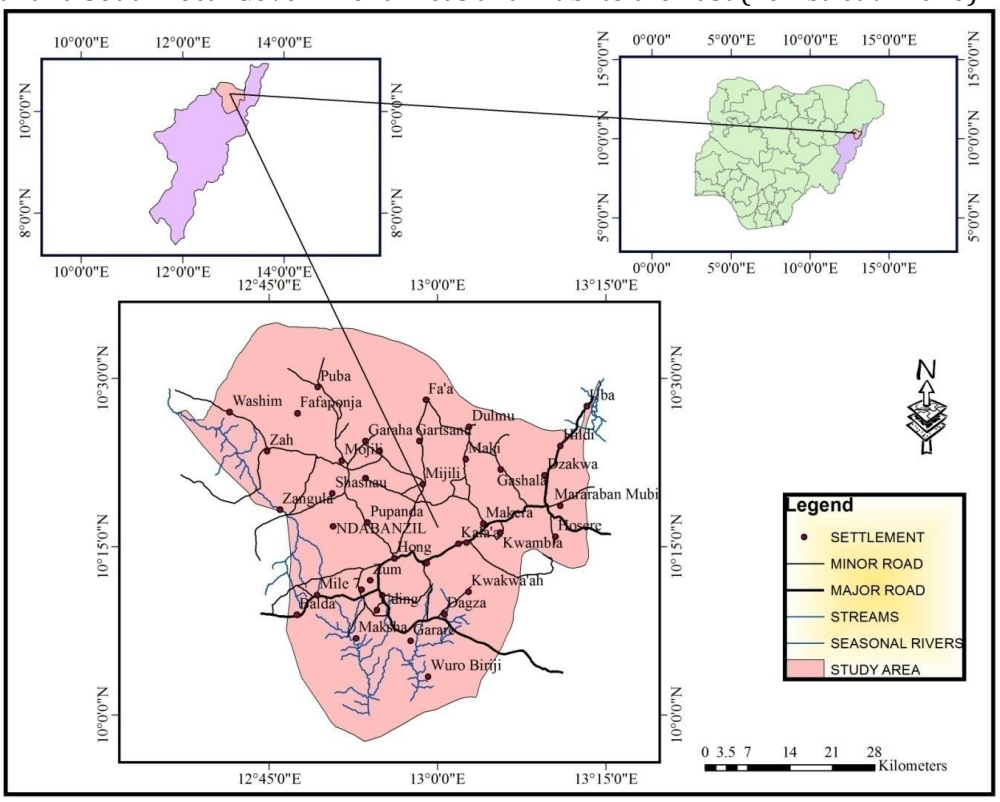

Figure 1.1: Vertical Electrical Sounding Sites of the Study Area
Source: Gundiri, 2024

Materials

The following materials were used for the study:
Terra-meter ABEM SAS 4000, Coiled wire, Tape, Hammer, GPS (Garmin 60), Current and potential electrodes, D.C Battery 12volts and Computer system

Software

Software used for the study are as follows:
i. ArcGIS 10.1 for geo-statistical analysis
ii. Interpex IX1Dv2 for plotting of obtained geo-electrical data.

Aquifer depth and thickness estimation using vertical electrical sounding

Estimation of aquifer depth and thickness was performed using Vertical Electrical Sounding (VES) a Schlumberger array (Figure 2). The data was obtained in the field where the study area is located. The obtained data was plotted in Interpex IX1Dv2 and estimated aquifer depth and thicknesses were obtained.

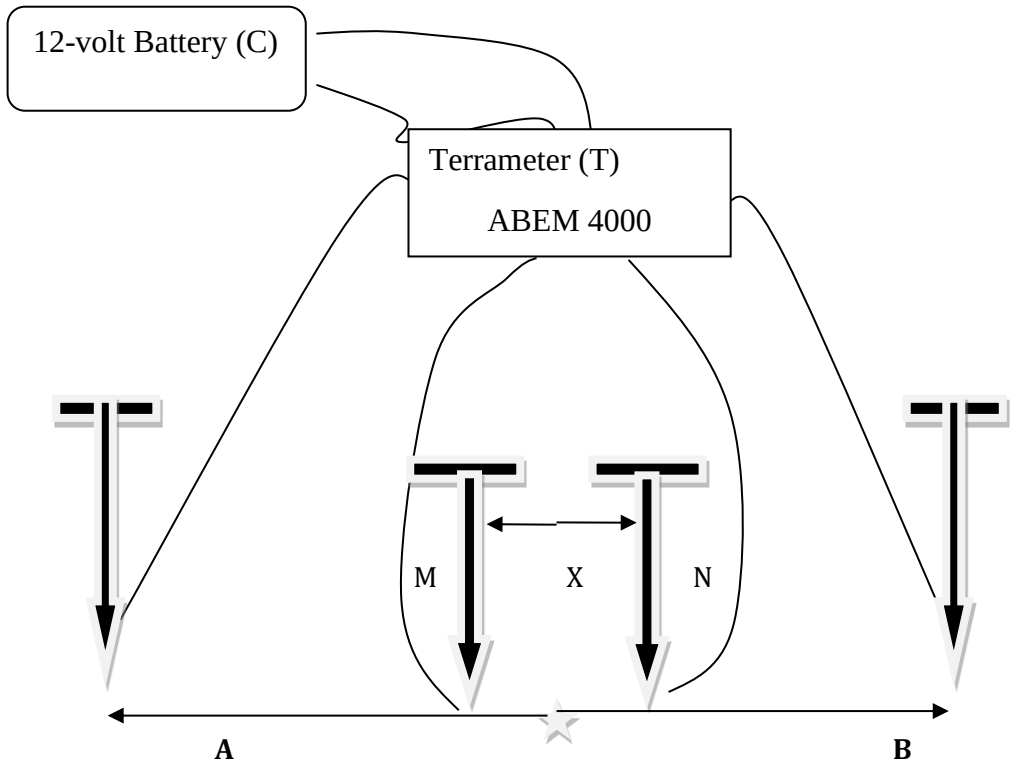

Figure 2: Configuration of Schlumberger Array for Vertical Electrical Sounding

In Mijili a sample point X (Figure 2) was identified on the ground and ground coordinates were obtained. At the first sounding measurement, the current electrodes A and B were placed at a distance of 1m at either side of point X, while the potential electrodes M and N were placed at a distance of 0.2m at either side of point X. For subsequent sounding measurements, the current electrodes (A and B) and potential electrodes (M and N) were moved further apart progressively, with A&B ranging from 1m to a maximum of 100m away from X; and M & N ranging from 0.2 to a maximum of 1.5m away from X. Steel rods were used to range the alignment thus making them perfectly straight. At both points M and N (potential electrodes) the steel rods were pegged. When the current electrode spacing is at a maximum of 10.0m, then the spacing of potential electrode XM and XN was changed to 1.5m. The reason for the separation of current electrode AB/2 is that the current penetrates continuously deeper with increasing separation of current electrodes.

The steel rods at point A, M, N, B were connected using cables to the terrameter (T), the terrameter was then powered by a 12-volt Battery (C). The connection was done in such a way that A and B receives current from the terrameter while MN emits current received from the ground into the terrameter. Therefore, while cables at TA and TB are emitting current to the ground, cables MT and NT are receiving the returned signal back to the terrameter. The readings were taken by the terrameter, and it was used to measure and record the resistance of the subsurface. The terrameter reads the signals from M and N and outputs a reading known as the resistance. The values of the resistance obtained in the field were multiplied by their respective Geometric factor (G) for each spacing of the electrodes. This gives the required apparent resistivity results. Geometric factor is a numerical multiplier defined by the geometrical spacing between electrodes. This becomes the reading for Mijili. The same procedure was adopted for the 40 sampling points in the study area.

Mapping of Estimated Aquifer Depths and Thicknesses using Geostatistics (Stochastic Interpolation)

Geo-statistic was used to produce the map of estimated aquifer depths and thicknesses. The data used for the geostatistical estimation are Aquifer depths and Thicknesses from the summary of table

of Vertical Electrical Sounding (VES) parameters of the study area (Table 1). The aquifer depths data was explored to check for normality of the data using histogram from geostatistics wizard of ArcGIS 10.1, check for the presence of trend and decide the order of removal and finally produce the map of estimated aquifer depth and thickness.

Model cross validation (comparison)

After the geostatistical estimation, cross validation table generated the statistics that quantifies the errors for both aquifer depths and thicknesses. The comparison was assessed based on the Smallest Mean Square Error (RMSE) with a condition that the Average Standard Error (AVE) should be close to the Root Mean Squared prediction errors (RMSE); if these conditions are satisfied; you are correctly assessing the variability in prediction, hence accepted. This process was accomplished based on (Esri 2012) and Kalpana and Pramila (2011).

Mapping of confined aquifers for Manual Drilling

In order to determine the feasibility of manual drilling, the criteria utilized by Fussi (2017) was adopted, this includes aquifer depths threshold to a maximum of 40 meters for the feasibility of manual drilling and aquifer thickness between 0 to 50 meters. The parameters used in identifying the confined aquifer were the output from the best geostatistical methods for both aquifer depths and thicknesses. Probability Kriging, was used in producing the map of confined aquifer, using a threshold value above 30 meters for both aquifer depths and thicknesses because it is less vulnerable to pollution through infiltration. The output from this analysis was a binary map with 1 indicating areas of confined aquifers and 0 indicating unconfined aquifers areas. Raster calculator was then used to multiply the two binary maps (aquifer depths and aquifer thicknesses) to show areas of confined and unconfined aquifers.

Results

Estimated Aquifer Depths and Thicknesses from Vertical Electrical Sounding

After data collection of Vertical Electrical Sounding and plotting, the output from the plotting produced a graph that determines the number of layers, their depths, thicknesses, and respective resistivity. The geologic section for the sounding locations shows three to four geologic layers. Low resistivity values indicate presence of aquifer whereas, sharp increase in the resistivity values indicate absence of aquifer, thus making it a fresh basement. In extracting the layer information for aquifer in the study area, the resistivity values were carefully observed. Mijili, ShuwaKala'a, Uba, HildiDzakwa, MarabanMubi, Gashala, Makera, Gartsanu, Kubutava, Washim, Mojili, Zangula, Hosere, Puba, Shashau, WuroBoki, Zah, Pupanda, Fafaponja, Ndabanza, Garaha, Mugwalar and Kwambla indicated four (4) distinct geologic layers. The third layer is the aquifer unit with resistivity values that ranges from 10.0Ωm to 813.48Ωm, but a sharp increase was noticed in the fourth layer with resistivity that ranges from 208.01Ωm to 13018.0Ωm thus making it a fresh basement, therefore, the region between third and fourth layer is the aquifer unit.

Similarly, Dulmu, Fadama Rake, Kwakwah, Hildi, Kala'a, Hong, Dagza, Fachi, Garare, Mile 7, Ngalbi Pella, Uding, Zum, WuroBiriji, Maksha, Fa'a and Maki show three (3) distinct layers. The second layer is the aquifer unit of the area with low resistivity values that ranges from 22.097Ωm to 224.09Ωm, but a sharp increase was noticed in the third layer with resistivity that ranges from 174.97Ωm to 4202.4Ωm indicating absence of aquifer (fresh basement), therefore, the region between second and third layer is the aquifer unit. The areas that constitute optimum groundwater potential are Dulmu, FadamaRake, Kwakwa'ah, Hildi, Kala'a, Hong, Dagza, Fachi, Mile 7, Ngalbi, Uding, Zum and Fa'a with resistivity of 22.183Ωm to 94. 067Ωm.Garare Zum, Wuro Biriji and Maki constitute areas with medium aquifer condition with resistivity values of 113.03Ωm and 229.37Ωm.

Table 1: Summary of Measured Vertical Electrical Sounding (VES) Parameters of the Study Area

SN	Sample Location	Lat.	Long.	Res. 1	Res. 2	Res. 3	Res. 4	Aquifer Thickness (m)	Aquifer Depth (m)
1	Mijili	10.3425	12.9783	194.77	42.699	167.58	3131.7	40.374	53.603
2	ShuwaKala'a	10.2561	13.043	165.02	32.519	206.04	1679.4	46.964	53.481
3	Uba	10.4589	13.2219	50.396	120.25	39.751	208.42	39.94	43.855
4	Dzakwa	10.3562	13.159	79.727	40.226	97.409	6852.4	44.776	51.543
5	MararabanMubi	10.3112	13.1827	229.51	122.12	63.303	8928.9	16.67	22.111
6	Gashala	10.365	13.094	476.43	112.65	85.349	9093.3	32.655	39.12
7	Makera	10.284	13.068	370.26	101.86	83.253	4293.4	26.670	32.464
8	Gartsanu	10.407	12.973	144.7	41.918	128.94	12674.0	41.983	52.942
9	Kubutava	10.352	12.893	132.08	75.055	184.78	1147.3	20.634	27.166
10	Washim	10.45	12.691	17.492	57.487	532.81	954.58	37.695	48.953
11	Mojili	10.378	12.858	313.91	198.14	513.21	2907.8	21.706	28.153
12	Zangula	10.305	12.766	40.829	71.613	154.05	696.9	18.027	25.428
13	Hosere	10.265	13.175	482.22	156.03	127.53	13018	27.981	31.779
14	Puba	10.487	12.822	31.845	72.784	496.46	810.87	39.341	52.932
15	Shashau	10.329	12.844	36.167	69.758	414.7	794.19	42.712	54.68
16	WuroBoki	10.186	12.887	211.66	44.048	241.30	1677.7	56.446	69.791
17	Zah	10.392	12.747	39.528	79.632	471.16	762.67	39.899	53.958
18	Pupanda	10.286	12.896	7.19	12.612	10	7311.4	23.643	32.559
19	Fafaponja	10.448	12.792	392.00	328.10	849.31	4754.6	19.890	26.676
20	Ndabanza	10.28	12.845	206.77	172.47	794.55	3316.4	41.638	52.709
21	Garaha	10.407	12.893	446.77	229.71	566.32	3581.4	20.901	27.557
22	Mugwalar	10.392	12.914	298.07	133.03	329.02	2102.9	21.269	28.295
23	Kwambla	10.271	13.093	361.11	92.215	75.162	9003.3	25.630	31.117
24	Dulmu	10.428	13.047	130.02	66.336	706.56	-	14.457	15.838
25	Fadama Rake	10.226	12.984	88.796	29.972	2967.3	-	22.086	24.498
26	Kwakwa'ah	10.183	13.046	579.33	94.067	282.98	-	48.396	53.259
27	Hildi	10.3997	13.1827	216.12	57.839	555.58	-	19.119	21.199
28	Kala'a	10.2543	13.031	1208	71.935	5859.3	-	43.691	44.537
29	Hong	10.2329	12.9359	33.122	22.183	2196.1	-	20.747	21.961
30	Dagza	10.15	13.01	1191.2	70.340	5400.7	-	42.868	43.741
31	Fachi	10.149	12.791	84.084	30.248	1191.2	-	23.270	25.570
32	GarareZum	10.11	12.96	824.86	229.37	1373.6	-	28.236	32.659
33	Mile 7	10.1783	12.8211	239.88	61.249	175.1	-	30.104	31.11
34	Ngalbi	10.1775	12.9178	282.47	41.507	4202.4	-	27.038	30.629
35	Uding	10.1559	12.9101	59.21	73.797	667.05	-	17.358	20.365
36	Zum	10.2	12.9	262.5	31.304	3227.0	-	25.221	28.72
37	WuroBiriji	10.057	12.986	362.55	113.03	696.95	-	21.834	26.408
38	Maksha	10.114	12.879	492.04	170.92	1078.5	-	19.054	23.572
39	Fa'a	10.468	12.983	199.46	88.805	1007.3	-	15.451	16.56
40	Maki	10.38	13.042	365.54	123.23	1610.7	-	23.044	24.256

Comparison of statistical results of estimated aquifer depths and thicknesses

In this research, Universal Kriging circular model produced a map (Figure 4) and performed best for aquifer depth estimation because of the strong relationship between Root Mean Square Error and

the Average Standard Errors as seen in the statistical table (Table 2) and graph of linear relationship (Figure 2), The result of the statistics for estimated aquifer depth estimation is in agreement with the work of Partha and Jyotiprava (2017) and Hassan (2018). While Ordinary Kriging exponential model produced a map for estimated aquifer depth (Figure 5) and it performed best because ASE and RMSE are closely related (table 3) and Figure (3). The statistics result for aquifer thickness is in agreement with Yao *et al.* (2014).

Table 2: Cross Validation Table (Statistics) for Estimated Aquifer Depths

Models	**Kriging Estimators**	**Mean Error**	**Root Mean Square Error**	**Mean Standardized Error**	**Root Mean Square Standardized**	**Average standard Error**
Circular	Simple	-0.007	13.755	-0.031	1.075	12.95
	Universal	**-1.509**	**14.397**	**-0.164**	**1.116**	**14.53**
	Ordinary	0.094	13.473	-0.017	0.988	14.06
Exponential	Simple	-0.007	13.755	-0.031	1.075	12.95
	Universal	-1.51	14.377	-0.163	1.11	14.6
	Ordinary	0.079	13.508	-0.019	0.996	14.02
Gaussian	Simple	-0.007	13.755	-0.031	1.075	12.95
	Universal	-1.516	14.386	-0.164	1.112	14.58
	Ordinary	0.092	13.477	-0.017	0.989	14.05
Spherical	Simple	0.228	13.73	-0.014	1.038	13.5
	Universal	-1.511	14.388	-0.164	1.113	14.58
	Ordinary	0.094	13.473	-0.017	0.988	14.06

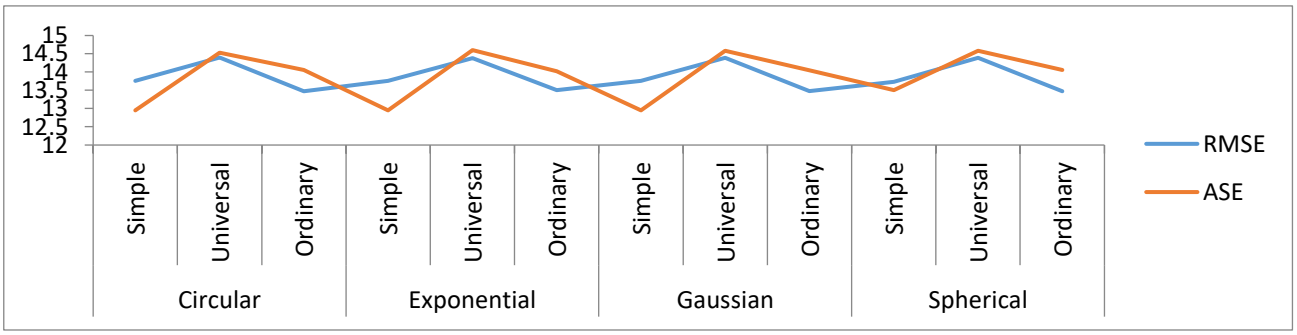

Figure 2: Relationship between Root Mean Square Error with Average Standard Error for Aquifer Depths

Table 5.2: Cross Validation Table (Statistics) for Estimated Aquifer Thicknesses

Models	Kriging Estimators	Mean Error	Root Mean Square Error	Mean Standardized Error	Root Mean Square Standardized	Average standard Error
Circular	Simple	0.045	11.28	-0.027	1.068	10.69
	Universal	-1.396	11.831	-0.172	1.103	11.54
	Ordinary	-0.093	11.153	-0.037	1.016	11.25
Exponential	Simple	0.122	11.223	-0.019	1.058	10.76
	Universal	-1.397	11.821	-0.172	1.097	11.59
	Ordinary	**-0.097**	**11.149**	**-0.037**	**1.018**	**11.24**
Gaussian	Simple	0.041	11.284	-0.027	1.069	10.69
	Universal	-1.405	11.832	-0.172	1.1	11.57
	Ordinary	-0.091	11.147	-0.036	1.014	11.26

Spherical	Simple	-1.396	11.831	-0.172	1.101	11.56
	Universal	0.095	11.219	-0.022	1.06	10.73
	Ordinary	-0.088	11.138	-0.036	1.012	11.27

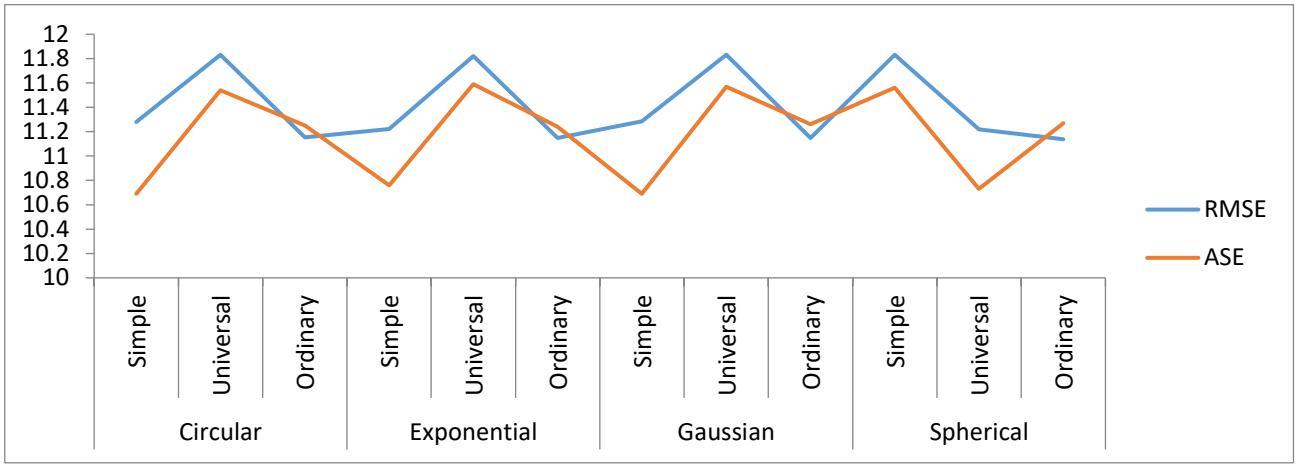

Figure 3: Relationship between Root Mean Square Error with Average Standard Error for Aquifer Thicknesses

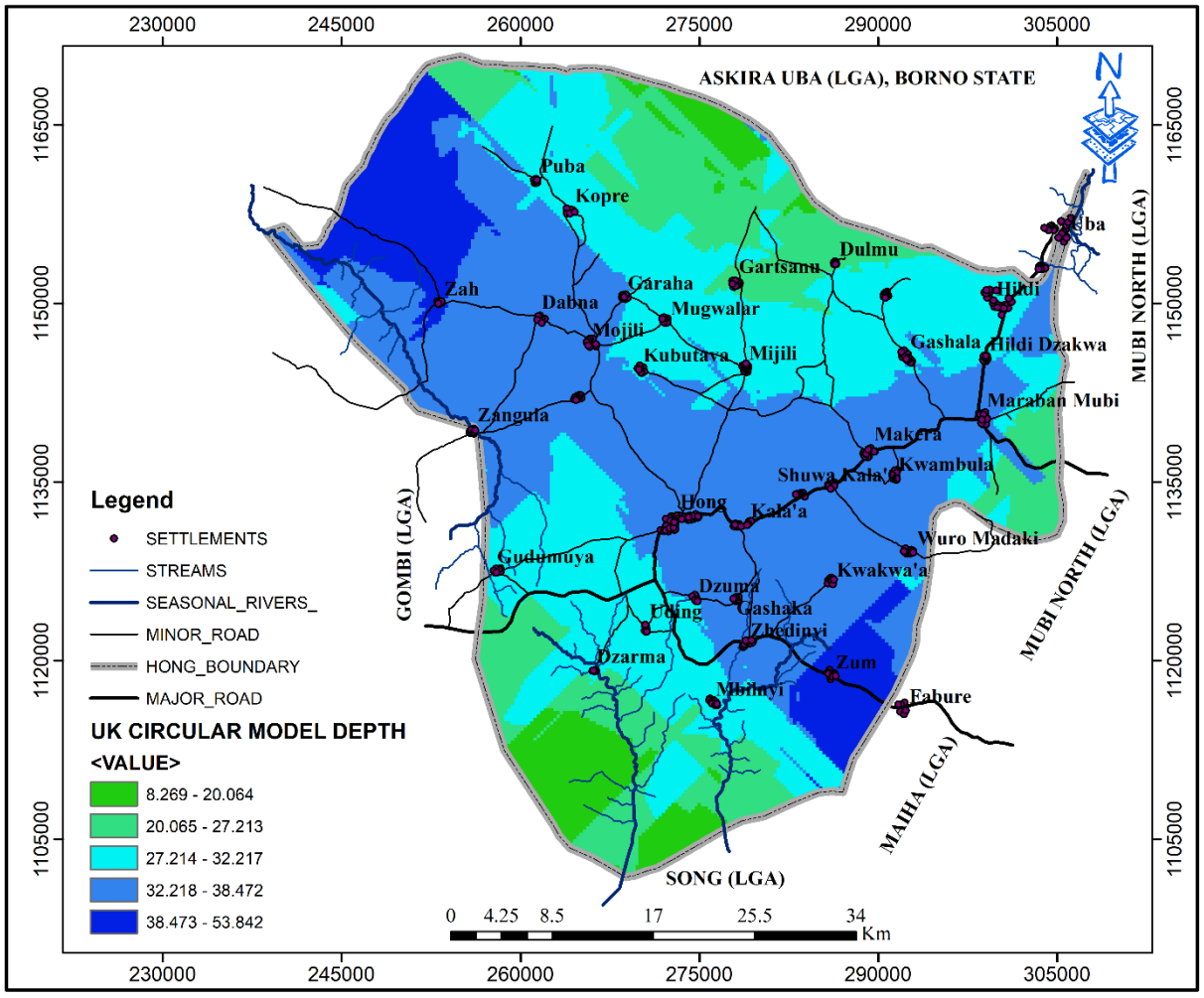

Figure 4: Universal Kriging Circular Model Map of Estimated Aquifer Depths

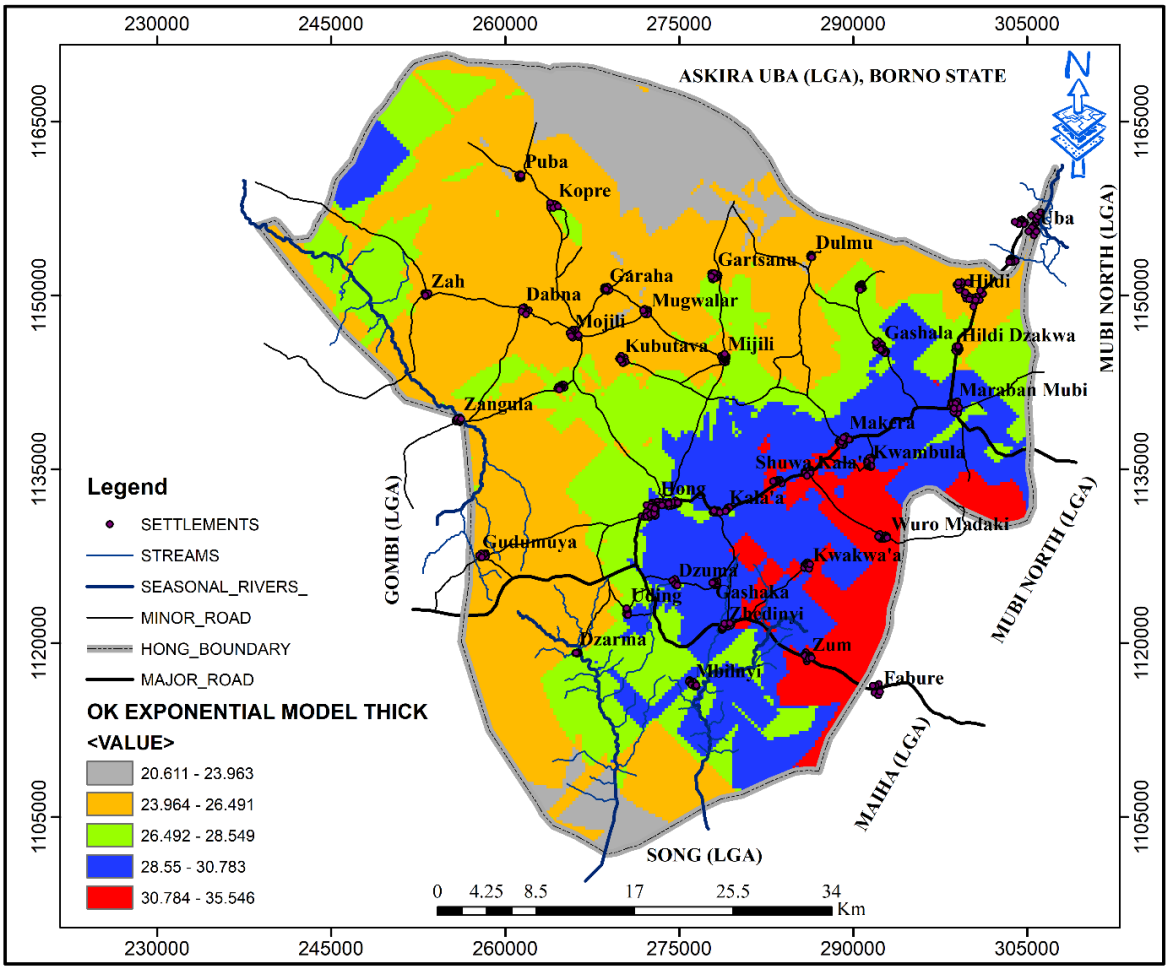

Figure 5: Ordinary Kriging Exponential Model Map of Estimated Aquifer Thicknesses

Confined Aquifers Mapping for Manual Drilling

The results of confined aquifer were obtained in the form of maps. The maps used for identifying area of confined aquifers are the results of the best estimation model for aquifer depths (Universal kriging circular model) and aquifer thickness (Ordinaty Kriging exponential model). Ordinary Kriging was used in identifying confined aquifers, these maps are binary map for aquifer depths (Figure 6) and aquifer thickness (Figure 7). The result of the confined aquifer as obtained from the multiplication of the two binary images is the map showing confined and unconfined aquifer areas (Figure 8).

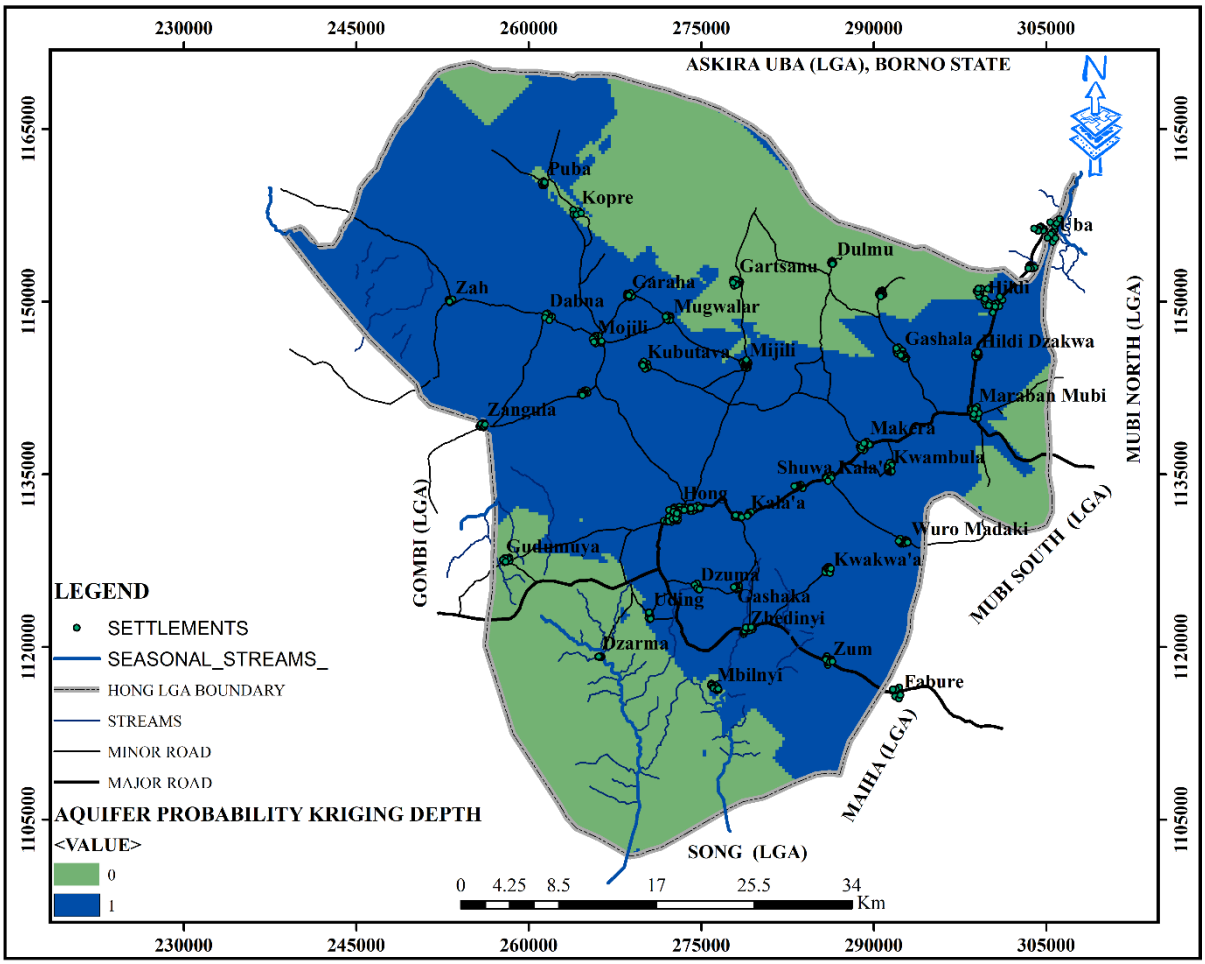

Figure 6: Probability Kriging Map For Aquifer Depths greater than 30 Meters

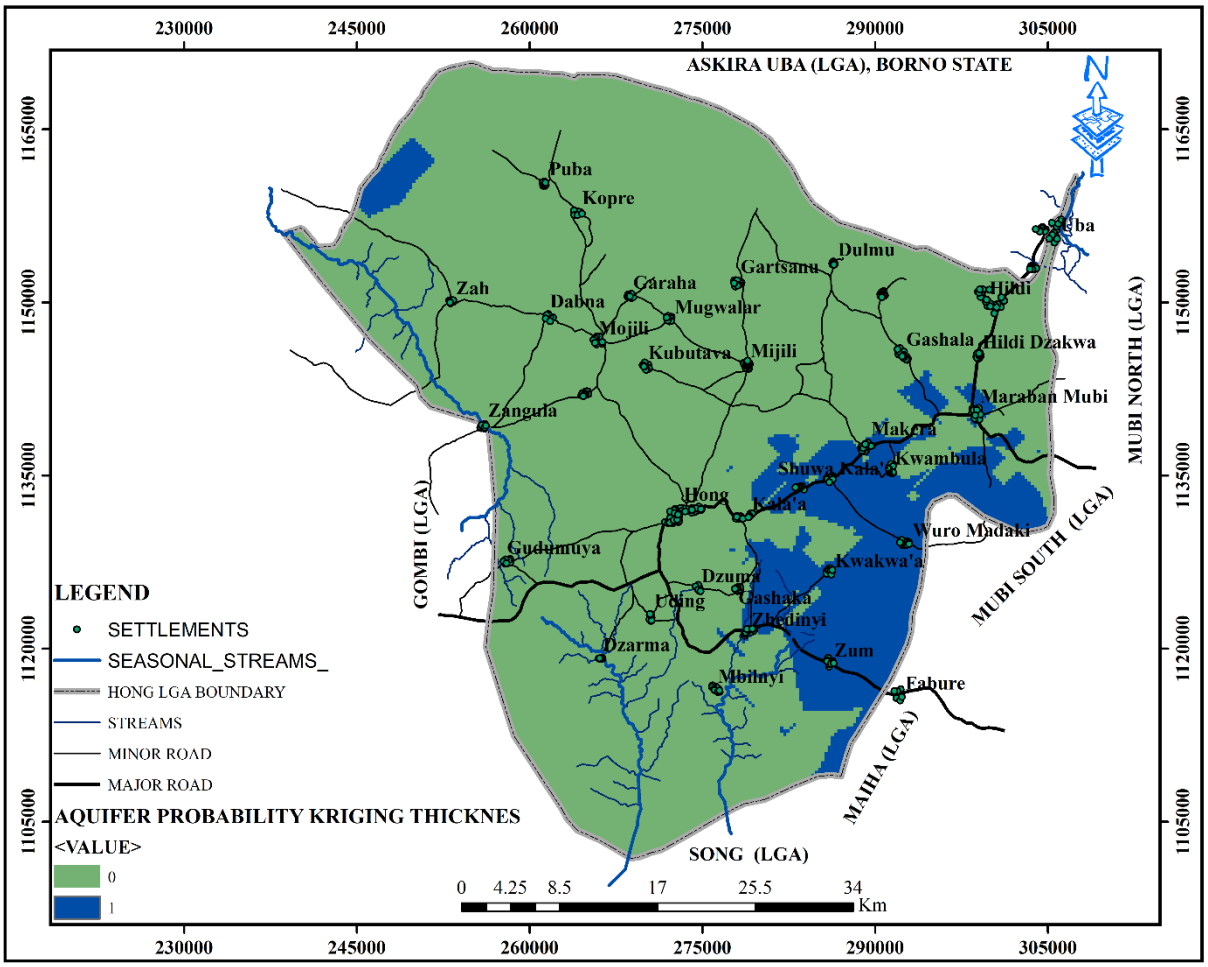

Figure 7: Probability Kriging Map for Aquifer Thicknesses greater than 30 Meters

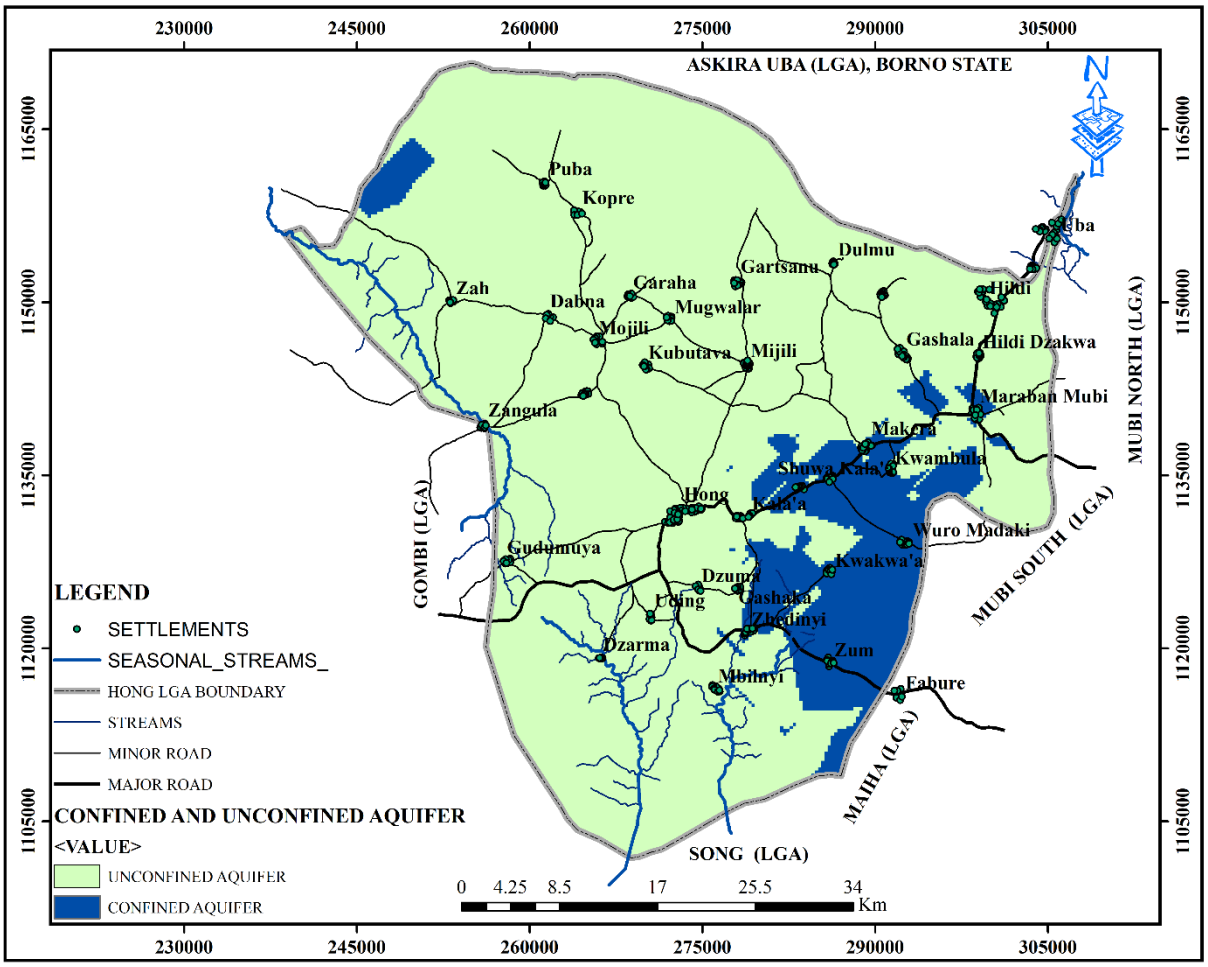

Figure 8: Map of Confined Aquifers for Manual Drilling

For confined aquifers map production for manual drilling, the output from the best Probability Kriging for aquifer depths greater than 30 meters (Figure 6), this indicated that the central part of the study area is deeper compared to other places as indicated in blue colour, the affected areas are villages around Zah, Dabna, Mojili, Zangula, Hong, Kwakwa, ShuwaKala'a, MrarabanMubi, Hildi, Uba, Gashala, Mijili, and Garaha making the area promising for manual drilling while the northern and southern part has a depth less than 30 meter, they are shallower. The affected areas are Dulmu, Gartsanu, Mugwalar, Kopre and Dzarma. The Probability Kriging map for aquifer thickness greater than 30 meters (Figure 7) indicated that it is the thickest and has the potential of manual drilling, these affect mostly the Eastern part of the study area, the areas affected are; Dzuma, kwakwa, ShuwaKala'a, Zum, ShuwaKala'a and Gashaka while areas that are un-confined based on the parameter used affect Puba, Kopre, Hildi, Uba, Mijili, Gartsanu, Mugwlar, Garaha, Mojili, Zangula, Zah and Dabna. The final map as obtained from the multiplication of the two probability maps (Probability Kriging) produces a map that shows areas of confined and unconfined aquifer, the confine areas are areas suitable for manual drilling. Places like Dzuma, kwakwa, ShuwaKala'a, Zum, ShuwaKala'a, Makera partly Mararaban Mubi and Gashaka are more confined (Figure 8) and has the potential for manual drilling.

Conclusion

This research estimated the aquifer depths and thicknesses using Vertical Electrical Sounding (VES) and produced the map of estimated aquifer depths and thicknesses using geostatistics methods. The villages around Dzuma, Kwakwa'a, Zum, Shuwa Kala'a, Gashala, Makera and partly Mararaban Mubi are identified as areas of confined aquifers and suitable for manual drilling. This knowledge has improved the ability to understand the hydrogeology of the study area.

Recommendations

Findings from this study revealed that aquifer mapping for water production is an important alternative in boosting water production in the area. It is on this basis that, other geophysical methods of data collection can be adopted in other research and compare results. The mapping approach and techniques used can be applied in other part of the globe. This approach can be used for the exploration of other mineral resources. Assess the performance of probability kriging with other non-parametric Kriging methods in identifying suitable sites for manual drilling.

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THE EFFECTIVENESS OF ARTS-BASED APPROACHES IN SUSTAINING CULTURAL PRACTICES AMONG INTERNALLY DISPLACED PERSONS IN BAKASSI CAMP, BORNO STATE

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Abstract
This study explores the effectiveness of arts-based approaches(ABA) in sustaining traditional cultural practices among Internally Displaced Persons (IDPs) residing in Bakassi Camp, Borno State, Nigeria. With displacement disrupting the cultural continuity of affected communities, particularly in the aftermath of the Boko Haram insurgency, this research highlights the critical role of arts visual representation, in preserving cultural identity and promoting psychological healing. By engaging displaced individuals in creative workshops, the study aimed to assess the effectiveness of using artistic methodologies in creating a conducive environment to explore challenges and opportunities of cultural continuity within the camp setting and offering evidence for integrating cultural preservation into humanitarian interventions. The findings this research underscore the importance of arts as both a therapeutic tool and a means of fostering social cohesion in post-conflict settings, especially amongst the Internally Displaced.

Keywords: Internally Displaced Persons, Arts-Based Approaches, Traditional Music, Cultural Preservation, Bakassi Camp, Psychological Healing, Peacebuilding, Social Cohesion

Introduction

Borno State, the epicenter of Boko Haram insurgency, has seen the largest number of displaced persons. Among these displaced populations, the Kanuri ethnic group, native to the region, have faced the imminent threat of losing their cultural practices, particularly traditional music and other forms of art that are central to their identity (Oluwagbemiga, 2017). The displacement crisis has further led to the cultural erosion amongst the Internally displaced persons (IDP). The study, conducted in Bakassi Camp in 2019, Borno State, investigates the potential effectiveness of arts-based interventions, specifically through traditional music and visual arts, as tools for sustaining cultural practices among the displaced. Furthermore, it aims to understand how such practices can promote psychological healing, social cohesion, and collective resilience in a post-trauma environment. This displacement crisis caused by the Boko Haram insurgency in the northeast has led to a staggering number of internally displaced persons (IDPs). According to the United Nations High Commissioner for Refugees (UNHCR, 2020), over two million Nigerians were displaced within the country. The impact of displacement extends beyond the loss of homes and livelihoods to encompass significant cultural disruptions. The forced relocation of individuals often results in the loss of social structures, rituals, and practices that are integral to the identity of individuals and their community. Though there have been a lot of interventions by non-governmental institutions and governmental using different strategies such as workshops, talks, town hall meetings, there seems to exist some gaps that are still of concern. Hence this study aims to explore a different kind of approach which with foundations within artistic proponent by studying the effectiveness of arts-based research to bridge this gap.

Arts-based approaches (ABA) such as music, dance, drama, drawing are increasingly recognized for their role in both mental health recovery and cultural preservation in conflict-affected settings (Eyong, 2022; Ogunleye, 2023). According to Leighton and Pelham (2007), creative interventions not only provide therapeutic benefits but also offer displaced individuals a means of reconnecting with their cultural heritage. This article highlights how such interventions can contribute to the long-term well-being of IDPs by offering them opportunities for self-expression, cultural education, and collective healing.

Arts a Cultural Preservation Tool in Displacement Settings

The erosion of cultural identity is a critical concern among Internally Displaced Persons (IDPs), particularly in regions like Borno State, where prolonged insurgency has disrupted the traditional ways of life of the people. Arts-based Approaches (ABAs) have emerged as vital tools for sustaining intangible cultural heritage. Recent studies in African displacement contexts demonstrate how performative and visual arts help communities retain collective memory.

For instance, among the South Sudanese refugees in Uganda, traditional dance (Agwara) and song repertoires have been strategically adapted in camp settings to preserve cultural narratives for a long time with evidence of success (Nannyonga-Tamusuza, 2021). Similarly, in Nigeria, the Durbar festival a historically significant ceremony among Hausa-Fulani communities has been re-enacted in IDP camps like Bakassi to reinforce cultural continuity and social cohesive living amongst the IDP's (Abdullahi & Danjibo, 2023). Another example is the Bori spirit possession dance, a native dance performance of the Hausa people in Sokoto, Kano and Katsina, which despite its religious significance, has been modified into secular performances to ensure its survival among displaced communities (Adamu, 2022). This modification has also been largely due to the assimilation of popular cultural performance and the change in demographics, though the dance still maintains its cultural essence (Adamu, 2022). Looking further inward is an initiative such as the Saving Heritage Art and Culture (SHAC) project in Bakassi camp which employed storytelling and craft-making to document Kanuri proverbs, folktales, and weaving techniques (Bala, 2023). Such efforts have proven to align with UNESCO's (2022) framework on safeguarding intangible cultural heritage in crisis zones, emphasizing ABAs as an effective counterforce against cultural amnesia and eventual phasing out.

Objective
The objective of this research is to explore the effectiveness of arts-based approaches in sustaining traditional cultural practices among Internally Displaced Persons using two different arts base approaches.

Scope of the Study
The geographical scope of the study is Maiduguri Borno State, delimited to Bakassi camp, while the population of the study was taken from a sample number of Internally Displaced persons living within the Bakassi Camp.

Literature Review
Arts-based approaches in displacement contexts have gained significant attention in recent years, particularly in relation to their therapeutic and cultural value. Scholars have explored the impact of arts in both war-torn societies and refugee camps, finding that arts can help displaced individuals process trauma, rebuild social bonds, and maintain cultural continuity (Harris, 2019; Mernissi, 2018). In a similar vein, this study builds on existing research (Eyong, 2022; Ogunleye, 2023; Leighton, 2007) by examining how visual representations can foster a sense of belonging and identity among IDPs in Bakassi Camp.

Visual Arts and Cultural Identity
Visual arts, including painting, drawing, and sculpture, are similarly powerful tools for personal expression and cultural preservation. As noted by Dissanayake (2015), visual arts can communicate emotions that words cannot, making them an ideal medium for displaced individuals to express complex feelings of loss, displacement, and hope. In the context of Bakassi Camp, the art of visuality provided participants with a platform to represent their experiences of conflict and envision a peaceful future, offering a creative outlet for suppressed traumatic feelings and a means of asserting cultural identity. This was achieved through a drawing participatory method in form of drawing sessions.

Cultural Continuity in Displacement Contexts
Cultural preservation is a significant concern for displaced communities, who often experience a rupture in their cultural practices and knowledge transmission due to displacement. According to Gergen, et al. (2001), cultural practices are not merely symbolic means of expressions but are central to an individual's sense of identity. For IDPs, particularly in the aftermath of violent conflict, the disruption of these cultural practices can exacerbate feelings of alienation and despair which might lead an individual self-alienation or depression. In this context, arts-based approaches become instrumental in ensuring the continuity of cultural heritage.

However, sustaining cultural practices in displacement settings presents several challenges, such as the disruption of certain systems that have been established already with the continuous addition of internally displaced person who come anew with a different view. The disruption of social structures, loss of access to cultural materials, and the overwhelming need for survival often impede the ability of displaced persons to engage in cultural activities (Harris, 2019). Despite these challenges, arts interventions that engage displaced persons in the process of cultural education and creative expression can serve as a lifeline, preserving cultural practices while simultaneously promoting social integration and healing.

Psychosocial and Communal Benefits of Arts-Based Interventions
Beyond cultural preservation, ABAs have served and is still serving as therapeutic tools, addressing trauma and fostering social cohesion among displaced populations as has been shown in the different context above. Research has shown that these participatory arts interventions have been particularly effective in mitigating the psychological impacts of conflict. Such examples are a study in 2023 conducted in Bakassi Camp which revealed that drama therapy programs significantly reduced symptoms of post-traumatic stress disorder (PTSD) among displaced children, with

collective performances restoring a sense of normalcy and peer support (Mohammed and Shehu, 2023). A further example is a Kenyan study conducted in Kakuma refugee camp with parallel findings where visual arts workshops enabled displaced youth to process traumatic experiences through painting and sculpture, improving emotional regulation (Okeke-Ihejirika et al., 2022). More reference to ABA is on the pivotal role music played an initiative in South Sudan called the "Arts for Peace" which was used communal songwriting to bridge ethnic divisions among displaced groups, demonstrating how collaborative artistic expression can rebuild trust (African Arts Institute, 2022). In Nigeria, the "Music for Healing" project in Borno incorporated traditional Goge (fiddle) music into trauma counseling sessions, reporting enhanced emotional resilience among participants (Dauda and Yusuf, 2024).

Compounding Theoretical Underpinning

Arts-based approaches (ABAs) have a dual function in displaced communities, as both acts of cultural resistance and vehicles for psychosocial healing which presents a compelling area for theoretical examination in this research. This discussion analyzes these intertwined roles through the complementary frameworks of Cultural Resilience Theory (Eyong, 2022), with empirical grounding from Nigeria's Bakassi IDP Camp. The analysis reveals how this theory collectively explains ABAs' transformative potential in contexts of systemic oppression and collective trauma. They further empathize the importance that visual representations hold with such a framework as the two theories.

Cultural Resilience Theory: Arts as Resistance to Cultural Erasure

Eyong's (2022) Cultural Resilience Theory provides critical insights into how displaced communities employ artistic expression as resistance against cultural annihilation his example is one taken from Bakassi Camp. This manifests through

1. Subversive Cultural Preservation: using a practical example from Adamu's (2022) covert continuation of the Bori spirit dance, whose performance historically was banned by the insurgents, has demonstrated how artistic practice can become acts of defiance.
2. Reclamation of Narratives: in the project 'Stories of Our Fathers' theatre production, singular trauma narratives was challenged by dramatizing pre-displacement life (Mohammed and Shehu, 2023). This agrees with Eyong's (2022) stipulation which terms 'counter-memory work' using performances to construct collective identity, beyond victimhood framework.

Nonetheless, limitations can be identified in policy applications. While Cultural Resilience theory effectively explains grassroots resistance, it inadequately addresses structural barriers like the exclusion of arts from the Nigerian IDP Policy.

In summary, the above discussion demonstrates that cultural resilience theory could provide a robust framework to aid the understanding of ABA's as both a shield) against cultural erasure) and to salve (for collective trauma). Its integration in policy briefs offers policymakers a foundation for psychosocial recovery.

Methodology

This study adopted a participatory action research (PAR) approach, which emphasized the active involvement of participants in the research process. PAR is particularly well-suited for contexts involving vulnerable populations such as the IDP's in this context, as it empowers participants to take ownership of the research process and ensures that their voices are heard (Reason & Bradbury, 2008). The study was conducted in Bakassi Camp, Borno State, a site that houses thousands of IDPs who have fled the Boko Haram insurgency.

Sample Population

The participants in this study were adult men and women, adolescent boys and adolescent girls, with a focus on those who were interested. The rationale for involving both the older and younger generations was to facilitate intergenerational knowledge transfer, which is essential for the preservation of cultural practices and ideologies on the concept of peace amongst the community

(Gergen et al., 2001). A total of 40 participants took part in the workshops: 15 adolescent boys and 15 adolescent girls, who were selected based on their interest to participate in the drawing sessions. The 10 adults was as a guiding cover who represented the leadership within the community.

Workshop Structure
The workshops were structured around two key themes: (1) promoting peace through visual arts and (2) feedback sessions by the adults. Each workshop was divided into three parts: a discussion session, a hands-on practical session, and a feedback session.

Drawing Sessions: The participants were asked to draw their understanding of peace and what it means to them personally, also including how it was before the Boko Haram insurgency and after the Boko Haram Insurgency. This process took two days, one day for the workshop session and the second session for drawing and feedback.

Discussion Session: Participants were invited to discuss their experiences with the drawing process and give a narration of what the drew.

Practical Session: This session included the creation of peace-oriented visual art, where participants used drawing to express their understanding of peace and coexistence.

Feedback Session: Participants were invited to share their experiences, reflect on the significance of the workshops, and suggest ways to improve cultural preservation within the camp.

Ethical consideration: The participants were all asked about their willingness to participate in the activities and if they consented to being recorded and photographed. All participants further signed consent forms to the effect.

Data Collection and Analysis
Data was collected through drawing sessions, direct observation, participant interviews, and feedback sessions. Thematic analysis was used to analyze the data, identifying key themes such as trauma recovery, cultural transmission, and the role of arts in rebuilding community bonds. The analysis aimed to assess the effectiveness of the workshops in sustaining cultural practices and promoting psychological healing.

Theme: Promoting Peace Through Visual Representation
Visual Arts as a Tool for Peacebuilding
Visual arts play a critical role in peacebuilding by allowing displaced individuals to express their hopes for the future and reflect on their experiences of conflict. In the Bakassi Camp drawing sessions, participants were asked to create visual representations of peace in a personalized context. The act of drawing provided a cathartic release for many of the participants, enabling them to process their suppressed trauma and express their aspirations for a return to normalcy.
The objective of this article is to understand the effectiveness of using arts-based approaches in concept of peace from the perspectives of a different set of IDPs, in the case those living within the Bakassi camp.

The participants in this session were displaced adolescent males and females, and adult men and women who have been living within the internally displaced camp since the destruction of their homes due to the Boko Haram crisis. The session started with a round of introduction by the facilitator where the reason for the workshop session was introduced and explained. Each participant introduced himself/herself followed by the singing local songs as ice breakers. After the introduction, the facilitator provided the participants with papers, crayons and pencils and asked them to draw what peace or peaceful coexistence means to them. The group are asked to work as individuals or as a group, which ever they felt comfortable with, and the participants swung into action and produced several images of what peace or peaceful coexistence meant to them.

One participant drew an image of a peaceful village, with children going to school and families working together in the fields. This image symbolized the hope for peace and stability in the future, as well as the desire to return to a life before the insurgency.

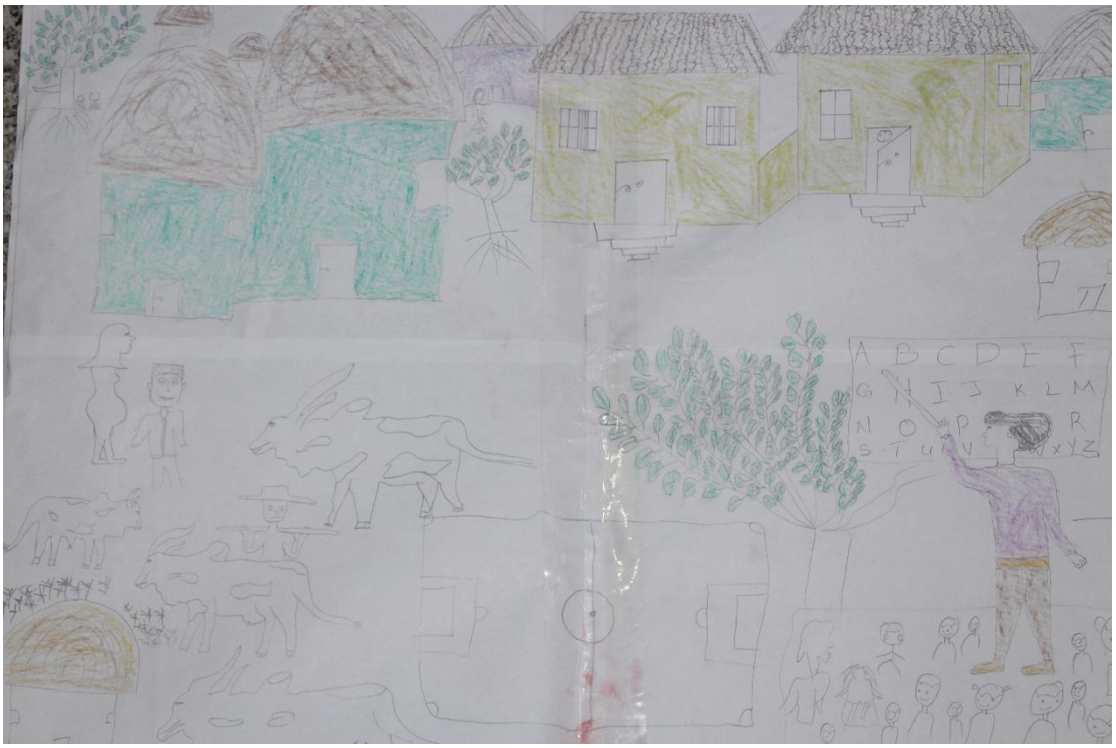

Plate 1, photo by Haruna, 2019. Drawing by respondent IDP7, A village setting

One participant drew an image of a peaceful village, with children going to school and families working together in the fields. According to participant IDP7 his image symbolized the hope for peace and stability in the future, as well as the desire to return to a life before the insurgency.

Another participant used the image of a bunch of broomsticks tied together to represent unity and peace. "*Just like the broomsticks are bound together, we too can come together to build peace*," she explained. This metaphor underscores the belief that peace requires collective effort and unity, a theme that resonates across displaced communities globally (Mernissi, 2018).

After the sketching session, the facilitator asked each participant to describe what each image represented, how it translates to the meaning of peace or peaceful existence and got various responses. Some of the responses by the respondents were based on how their lives were before the insurgency and while some just drew and gave narratives on how they envision peace to be or mean. Some of the different responses from the participants were;

Participant 3 said:

> "my drawing is showing Boko Haram members that came out from the bush to attack people, I was not among them but some of my family members were and those that survived told the story of what happened. So, I drew this because I want our situation to go back to before these attacks, when everything was peace and nice, when you could travel without scare that something bad will happen to you".

Plate 2; IDP9 photo by Yusuf, 2019. A male participant explaining the visual representation of peace and peaceful coexistence

Participant 2 explained:

> "This group of kids came together to go to school, which was the usual practice. So, for me, if peace doesn't exist, we can't go to school like we used to before".

Plate 3, photo by Haruna 2019. A female participant explaining representation of peace and peaceful coexistence.

Participant 4 said:

> "I drew our house in Monguno because that is where I find peace. For me peace means the ability to go back home and live there".

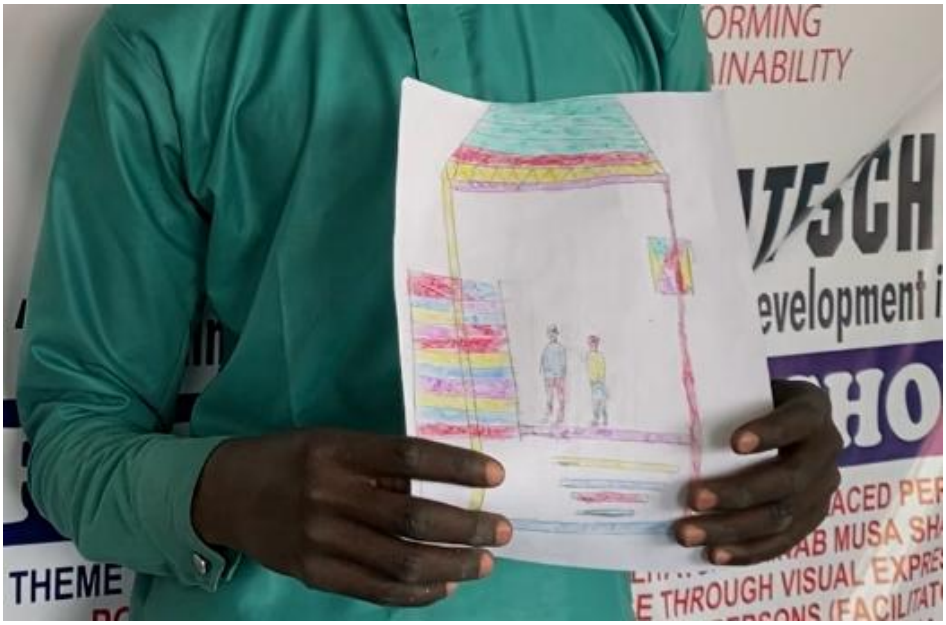

Plate 4, IDP 2 photo by Haruna 2019

Another participant used a bunch of brooms to describe what peace meant to her saying *"peace is like this bunch of broom sticks coming together to achieve one aim and purpose"*. While another participant used a piece of land with people farming to represent peace. He explained *"people can only go to farm when there is peace, so this is what peace means to me".*

From the various responses of the participants, one could deduce that the meaning and concept of peace really does vary from the different participants, but still, there is an underlying want that Maiduguri returns to normalcy (the participants' former way of life) across all depictions and narrations.

Discussion

The Role of Arts in Cultural Preservation and Healing

The findings of this study underscore the transformative potential of arts-based approaches in sustaining cultural practices among displaced populations. The workshops provided a space for participants to reconnect with their cultural roots through music and visual arts. As demonstrated by the positive feedback from participants, these activities helped reduce the sense of isolation often experienced in displacement settings and fostered a sense of collective identity.

In line with previous studies (Gergen et al., 2001; O'Donnell, 2012), arts-based interventions proved effective in promoting psychological healing. The act of engaging in music and visual arts allowed participants to externalize their trauma and regain a sense of agency, even in the face of displacement.

Social Cohesion and Peacebuilding through Arts

Beyond individual healing, arts-based approaches facilitated social cohesion within the camp. Music and visual arts workshops brought together individuals from different backgrounds and facilitated dialogue between generations. These interactions are crucial for building a sense of community and shared identity, both of which are essential for long-term peace building (Mernissi, 2018). Furthermore, visual arts provided a platform for participants to reflect on their experiences of violence and express their hopes for the future, thus promoting the culture of peace within the camp.

Challenges in Implementing Arts-Based Approaches

Despite their documented benefits, ABAs face structural and sociocultural barriers in IDP settings due to the cultural diversity composition of the internally displaced. Further, funding constraints remain a primary obstacle, as humanitarian aid often prioritizes immediate physical needs over cultural programs (Marfo & Okyerefo, 2023). Additionally, the lack of trained facilitators limits scalability. In Bakassi Camp, a 2024 evaluation noted that only two trained theater practitioners

were available for over 5,000 displaced persons, resulting in inconsistent programming (Yerima & Bello, 2024). Gender dynamics further complicate participation: conservative norms in Northern Nigeria sometimes restrict women from engaging in public performances, despite their historical roles in oral storytelling (Alubo, 2023). Resistance from camp administrators has also been reported, with some viewing cultural programs as non-essential compared to food and healthcare (UNHCR, 2023). However, advocates argue that neglecting cultural sustainability undermines long-term recovery, as identity loss exacerbates displacement trauma (Eyong, 2022).

Policy Implications: Integrating Arts-Based Approaches (ABAs) into Humanitarian Frameworks

The analysis of Cultural Resilience Theory (Eyong, 2022) underscores the critical need for policy reforms that institutionalize arts-based approaches (ABAs) in all forms of displacement settings. To address such dual imperatives of cultural preservation and psychosocial healing, humanitarian frameworks should adopt sone of the following strategic interventions:

1. **Recognize ABAs as Both Cultural Rights and Mental Health Interventions**: Current humanitarian policies are often silo cultural programs and mental health services, which fail to acknowledge their interdependence. Form previously stated evidence from Bakassi Camp, there seems a demonstration that ABAs: Safeguard intangible cultural heritage (e.g., Bori dances, Kanuri embroidery and crafts) as protected rights under UNESCO's 2003 Convention (UNESCO, 2022). These arts-based activities have proven tendencies to reduce PTSD symptoms by 37% among participants in theatre therapy (Mohammed & Shehu, 2023).
   Proposed Policy Action:
   There should be an amendment of Nigeria's National Policy on IDPs to classify ABAs as dual-purpose interventions under Sections 4.2 (Cultural Rights) and 5.1 (Mental Health). Align with the WHO's Arts and Health Framework (2023), which recognizes arts as non-clinical mental health support.

2. **Training of Trainers amongst IDPs in Art transferability to Ensure Sustainability**: Top-down ABA programs often collapse post-funding due to reliance on external funding and facilitators. A community-led model where IDPs are trained as practitioners offers long-term viability and sustainability mechanisms.
   Case Example:
   The SHAC Project in Borno trains displaced women to teach traditional weaving, creating income while preserving culture (Bala, 2023).
   Proposed Policy Action:
   Partner with Nigerian universities (e.g., University of Maiduguri, Collage of Education, Ramat the Train the Trainer model used in Uganda's refugee settlements (Nannyonga-Tamusuza, 2021).

3. **Allocate Specific Funding Lines for Cultural Psychosocial Hybrid Programs:** only 3% of humanitarian aid in Northeast Nigeria has previously targeted arts programs (UNHCR, 2023), despite its proven efficacy in terms psychosocial support. Hence it is essential that the government dedicates funding to avoid ad-hoc programming: E.g., Bakassi's mural project which lapsed after donor body exit from Borno State (Yerima & Bello, 2024).
   Policy Action:
   Create a UNHCR/NEMA (National Emergency Management Agency) joint fund for ABA initiatives, modelled after Kenya's Kakuma Art Fund. Mandate 5% earmarking of existing mental health budgets for arts therapies, per South Africa's Arts and Health Policy (2022).

Conclusion

To translate theory into practice, policymakers must:
1. Legislate ABAs as dual cultural-mental health interventions.
2. Invest in IDP-led capacity building to ensure program longevity and sustainability.

3. Ring-fence funding with accountability mechanisms which is rooted in community-based structures.

Further, this study demonstrates that arts-based approaches, such as visual arts, play an important role in sustaining cultural practices among displaced persons in Bakassi Camp. By providing a medium for creative expression, these interventions contribute to psychological healing, cultural preservation, and social cohesion. The artistic session findings suggest that such ABA approaches can be effectively integrated into humanitarian responses that could improve the well-being of displaced populations. Future research should explore the long-term impact of arts-based interventions and their potential for integration into broader peacebuilding and cultural preservation efforts for sustained peace promotion.

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INTEGRATING CULTURE INTO SUSTAINABILITY: A HOLISTIC FRAMEWORK FOR SUSTAINABLE DEVELOPMENT THROUGH ARCHITECTURE AND COMMUNITY PARTICIPATION

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Abstract
Sustainable development traditionally involves the three pillars of the economy, the environment, and social equity. These three are the basis on which politics, planning, and international development are decided. Over time, scholars, institutions, and communities have come to realise that this triadic model although instrumental, is not complete. The absence of culture, understood as the values, traditions, practices, and the creativity of the different communities, makes the sustainability models technically valid but often socially and contextually detached. Culture determines our interaction with the environment, the way we organise economic life, and the definition of social relationships. It is what determines people's concept of good life, progress, and responsibility. This paper corroborates the introduction of the culture factor as the fourth pillar of sustainability, and its integration with the economic, environmental, and social dimensions. Its purpose is to examine how cultural values and practices, when embedded into architectural processes and participatory planning, contribute to more inclusive, resilient, and context-sensitive sustainable development. Each of the pillars is respectively discussed in detail with a focus on their linkages and then dissects how culture enriches and binds them. The relevance of Architecture is further explored as a means of expressing and connecting all the four pillars, particularly in participatory and inclusive architectural processes. Through architecture, as the physical and cultural product, it offers communities the opportunity to reflect their identities, promote ecological harmony, and achieve economic and social resilience. The findings demonstrate that culturally grounded design approaches such as indigenous architecture and community participation improve project acceptance, lower environmental footprints, and enhance long-term sustainability outcomes. By embedding culture in sustainable development through built environments, especially in culturally diverse and developing regions, we foster systems that are more inclusive, durable, and locally grounded.

Keywords: Sustainable Development, Cultural Sustainability, Architecture, Community Participation, Inclusive Design, Indigenous Architecture, Green Economy.

Introduction

The term sustainability surfaced because of the pressing necessity to harmonize economic growth with ecological conservation and social welfare. The sustainability concept was first articulated by the 1987 Brundtland Report (Our Common Future) and referred to as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). The latter, in particular, set the stage for the consensus on the economic, environmental, and social sustainability principles as the tri-dimensional foundation of sustainable development. The function of these three policy areas was to be complementary and to guarantee that there was no growth at the cost of social justice or the environment.

However, with the progress of global development, and the involvement of more cultures and communities in the sustainability dialogues, it became obvious that the three pillars were still quite limited in encompassing the totality of human life. The cultural dimension, which is a key factor in the way societies perceive nature, structure their economies, and govern their social life, was usually overlooked. Culture is that sphere that determines the sustainability principles' interpretation and implementation, e.g., behavioral patterns, worldviews, and knowledge systems, etc., and without it, the sustainability project will remain technocratic and external. It won't be able to resonate with the communities that it aims to serve.

Therefore, certain scholars and organizations, such as UNESCO and the United Cities and Local Governments (UCLG), are advocating for culture to be the fourth pillar of sustainability (Hawkes, 2001; UCLG, 2004). This study investigates the interconnections between the three basic pillars and the role of the fourth pillar, and shows architecture, and particularly architectural design, to be very effective in a direct and practical way of bringing together all four pillars in a practical manner.

Theoretical Framework

A strong theoretical foundation is essential for understanding the multidimensional nature of sustainability. This study draws from three interrelated theories: Cultural Sustainability Theory, Systems Theory, and Participatory Design Theory. Each provides insight into how culture interacts with and enhances sustainability efforts.

Cultural Sustainability Theory

Cultural Sustainability Theory emphasizes that cultural practices, values, languages, and traditions are essential components of a society's ability to adapt, thrive, and sustain itself over time. Culture is not only a reflection of identity but a resource for resilience. According to Soini and Birkeland (2014), cultural sustainability involves preserving and fostering the cultural foundations that allow societies to be dynamic and resilient.

In the context of sustainable development, this theory provides a framework for understanding how traditional ecological knowledge, spiritual relationships to the environment, and local customs can enrich environmental, economic, and social sustainability. For instance, Berkes (2009) illustrates how Indigenous knowledge systems contribute to biodiversity conservation and natural resource management, offering practical tools and ethical guidance for sustainable living.

Systems Theory

Systems Theory views sustainability as a holistic and interconnected system, wherein economic, social, environmental, and cultural components influence and reinforce one another. The omission of one aspect such as culture can destabilize the entire system. Meadows (2008) underscores that systems thinking encourages long-term perspectives and an understanding of feedback loops within development processes.

Applying Systems Theory to sustainability suggests that culture cannot be isolated as a secondary concern. Rather, it acts as connective tissue that binds the other three pillars. For example,

environmentally sustainable technologies are more likely to be adopted when they align with local cultural practices and beliefs. The integration of cultural values helps tailor solutions to specific contexts, enhancing their relevance and effectiveness (UNESCO, 2013).

Participatory Design Theory

Participatory Design Theory asserts that involving stakeholders—especially local communities—in the design and planning of their environments leads to more inclusive, effective, and sustainable outcomes. Rooted in democratic and user-centered values, this theory challenges top-down planning by emphasizing co-creation and local empowerment.

Sanoff (2000) argues that participatory design not only yields better physical environments but also fosters social cohesion, ownership, and long-term maintenance. In architectural practice, participatory design has been linked to culturally responsive solutions that reflect community identity and needs. A notable example is the Medellín urban transformation project, where residents actively shaped the redesign of public spaces, resulting in reduced crime and increased civic pride (Hamdi, 2004).

Together, these theories establish a comprehensive framework for understanding and advancing the integration of culture into sustainability. They provide both the conceptual tools and empirical justification for recognizing culture as the fourth pillar in sustainable development discourse.

The Interconnections Between The Three Pillars Of Sustainability

Economic and Environmental Sustainability

The relationship between the economy and the environment is both synergistic and problematic. In one way, the production, energy, and infrastructure of the economic systems are mainly based on nature. The forests are the source of wood and ecosystem services; rivers are used for water and electrical power; minerals are a source of energy used in industry and technology. Conversely, the endless pursuit of the expansion of the economy, notably under capitalist models which are mostly extractive, has always been the main cause of the overuse of these resources. Unsustainable activities such as deforestation, burning fossil fuels, overfishing, and industrial pollution, have led to a decline in biodiversity, climate change, and health problems, all of which lead to economic systems gradually losing their own foundation (UNEP, 2011).

Actions to reduce this conflict have given birth to the concept of a green economy a circular economic system that reduces threats to the environment and increases development without ruining the environment. Central to it is the concept of the circular economy, which demands minimum waste through recycling, re-use, and closed loops. For instance, Ellen MacArthur Foundation (2013) noted that up to 90% of materials in companies are designing products for extended use lifespan and using materials for re-use applications, reducing consumption of virgin raw materials.

Furthermore, environmental economics introduces tools such as carbon pricing, cap-and-trade systems, and ecosystem valuation for internalising the environmental production and consumption costs. The "polluter pays" principle by which environment polluters pay the cost of mitigation becomes increasingly prevalent in environmental regulation. They stimulate cleaner technology innovation, reduce resource intensity, and align economic incentives with ecological sustainability (OECD, 2019).

Importantly, many countries are finding out that a sustainable economy in the long run can't be attained without ecological resilience. Meanwhile, nations such as Germany, Costa Rica, and Sweden have taken a stance on a wide range of sustainability goals and have invested in green energy and green infrastructure which, in addition to the economy, are also sustainable for nature (REN21, 2019).

Economic and Social Sustainability

The potential of economic growth to spread out and raise the standard of living of the people is associated with job creation, poverty reduction, and a source of tax revenues to public services like

education and health. On the contrary, the economic growth that leads to uneven distribution of resources and forced by the market only can be a major factor of the social gap. It is the social aspect of the three pillars of sustainability that is concerned with the essence of inclusive and equitable growth that allows all members of society, irrespective of gender, ethnic origin, or class, to benefit from economic progress (Raworth, 2017; Piketty, 2014).

It is true that in some areas of the world, lack of access to credit and markets has pushed vulnerable people to the edge of society. There are emerging ways to cope with the problems, for example, microfinance and social entrepreneurship. Grameen Bank, a lender operating entirely within the borders of Bangladesh, is one of the institutions that introduced the rural economy in that country to deep changes through the process of giving small sums of money to women and low-income entrepreneurs who are thus able to start up small businesses, become independent and contribute to their local communities with local development (Yunus, 2007).

Moreover, not only do Fair Trade systems (take as an example Fair Trade coffee) ensure that producers (The word "producer" is mainly used for the business company, while the person who makes goods is the manufacturer) from the Global South are given a fair recompense for their work and goods they produce but they also provide a model of ethical consumption and at the same time support the producer communities through the cycle of reinvestment via infrastructure and education (Nicholls & Opal, 2005).

Also, it must be noted that besides being regulated by businesses, economic systems are also the direct responsibility of governments and as such they need to be coordinated with social equity. Progressive taxation, universal basic income, targeted state subsidies on health, education, and housing are some of the measures that help to narrow the income inequality gap and at the same time to make society more cohesive (Stiglitz, 2012). One detail that stood out and has been generally recognized, a lesson that the COVID-19 pandemic has taught us is that the existence of strong social safety nets is essential. This was reinforced through millions of people who lost their jobs and faced health issues due to coronavirus, and as such, public intervention and solidarity was necessary (ILO, 2020; United Nations, 2020).

However, the state of the environment is sustainable only if the increase in the economic part of the environmentally sustainable developments is for the entire population, if the systems are made in a way that the primary/sole purpose would serve the general public instead of just a few privileged individuals.

Social and Environmental Sustainability

The linkage between of social and environmental sustainability is an environment in which environmental degradation influences human well-being and social cohesion. Clean air, drinkable water, nutritious food, and safe shelter are life necessities of people. If the previous ones get endangered, i.e. made unavailable due to pollution, climate change, or unsustainable urbanisation, then, the part of the society that is most in need will be the one to suffer the most. A concept of inequality is inherent and thus the environmental protection movement has come into existence. Its main message is that all people regardless of their social, ethnic and economic status have the right to a healthy environment which they deserve while social growth receives a minimum share of the blame for environmental issues (Bullard, 2005).

Local groups and communities from different parts of the globe have carried out initiatives on their own in order to protect the environment grassroots environmental movements and to demand changes in the environmental regulations advocating for equitable policies. The Chipko Movement in India is a well-known exemplar of the non-violent approach to saving trees from being cut. In the United States, communities of colour have mobilised against hazardous waste sites located in their neighbourhoods (Guha, 2000).

Public policy is another major element for blending environmental and social objectives. Sustainable urban planning including public transportation, green spaces, and affordable housing, are part of the elements, that, while increasing the quality of life, decrease the environmental impact. For instance, the implementation of policies such as the land tenure reformations, community forestry, and renewable energy cooperatives and the support given to local populations, to be in the position to manage resources in a sustainable and equitable manner (UN-Habitat, 2015).

Education and awareness components are elements of high importance. Incorporating environmental education into schools and community programs encourage environmental education and knowledge, aiding citizens to make informed decisions regarding sustainability. Social institutions that promote cooperative activities like cooperatives, neighbourhood associations, and local NGOs provide communities with the ability to deal with environmental changes and make a stand for their rights (UNESCO, 2013).

Culture As The Fourth Pillar Of Sustainability

Cultural Sustainability

Culture is the tool that expresses the way people see the world, identify their values, and act in their surroundings, it is beyond art, music, or heritage. It is the cultural lens through which people view the world and define their values, and act within their environments. Cultural sustainability refers to the process of making sure that the identities, traditions, and creative expressions of people are not only respected but also preserved while societies continue to grow. Distinct from the other three pillars, cultural aspect is often unseen, rather intangible, but it is visible in beliefs, rituals, languages, architecture, clothing, and worldviews. Nevertheless, it has a strong hold as it underpins all human endeavours, including resource allocation, composition of social institutions, and human-nature relations (UNESCO, 2001).

Indigenous people have a special kind of relationship with the environment and are often considered to be holistic. Their knowledge, which comes from many years of lived experience and the spirit of the land, is what informs them. The practices of rotational agriculture, seasonal foraging, and the preservation of sacred forests are not just sustainable, but they are the things that give a particular culture an identity (Anderson & Peters, 2017). Regrettably, examples exist where the traditions of the local communities have been rejected as backward or obscure, due to modern developments thereby causing cultural degradation and unintended consequences (Johnson, 2018).

Cultural sustainability promotion is the process of safeguarding the intangible cultural heritage - such as storytelling, traditional medicine, folk art, and community festivals. Another thing it means is encouraging activities in the creative field, linguistic skills preservation, and implementation of inclusive cultural policies (Throsby, 2010). These steps further strengthen the community's identity, resilience, and the sense of continued existence.

Culture As A Bridge Across Pillars

Culture is not a standalone dimension; it connects and enriches the other pillars. Economically, cultural industries generate employment, tourism, and innovation. Socially, culture fosters cohesion and a sense of belonging. Environmentally, it provides ethical frameworks and knowledge systems for interacting sustainably with ecosystems (Berkes, 2012).

Culture has a symbiotic relationship with all the other pillars; it interconnects with and contributes to the other main elements, each of the others feeds culture and is nourished by it. Economically, cultural industries are the ones which produce work, which are a source of tourism, and bring innovation into the scene. In terms of the social aspect, culture is a catalyst for solidarity and a sense of togetherness. It bestows people with the right to coexist in harmony. As the environment is concerned, it imparts morality and know-how in the ways of sustainable interaction with ecosystems (Turner et al., 2000).

Indigenous architecture (popularly referred to as Vernacular architecture in architectural terms) is an apt illustration of this mutual understanding. Constructing edifices in the traditional manner in different regions around the world—be it the mud huts in Mali, stone houses in Yemen or bamboo structures in Southeast Asia, are not only culturally significant but are also climate-responsive and eco-friendly (Oliver, 2003). The designs are born from a sequence of trial and error throughout many years of the adaptation to the locally available materials, social needs as well as the climate. The use of imported modernist models might lead to the creation of buildings that are not only energy inefficient but also not reflecting their culture (Vale & Vale, 1991).

Another illustration of this can be found in traditional ecological knowledge (TEK) that covers information on the weather, crop cycles, and the behaviour of species which has been passed by word of mouth. The assimilation of TEK with the prevailing scientific paradigms of traditional ecological knowledge (TEK) into formal scientific frameworks is a practice that has far-reaching implications for environmental management and community ownership in the context of sustainability (Berkes, 2009).

Global Recognition Of Culture

The globalised world has begun institutionalizing culture as part of sustainability agendas. Agenda 21 for Culture (UCLG, 2004) is an international charter declaring the contribution of culture towards sustainable development and requiring its placement into local and national agendas. UNESCO Creative Cities Network nurtures cities whose urban strategies revolve around creativity and culture, ranging from gastronomy in Parma to design in Helsinki.

The United Nations 2030 Agenda for Sustainable Development indirectly refers to culture in targets such as SDG 11.4, which seeks to protect the world's cultural and natural heritage. However, many cultural advocates feel that this recognition should go further, incorporating culture as an openly articulated fourth pillar into planning mechanisms and development indicators (UNESCO, 2013).

Architecture Within The Framework Of Sustainable Development

Architecture is one of the strongest articulation of human culture, a material articulation of how we imagine ourselves and where we stand in the world. But it is also a materially demanding practice with deep impacts on the environment, economy, and social structure. When guided by sustainability principles and contextualised through local culture, architecture can be an efficient vehicle to integral development.

Environmental Dimension

The construction of buildings and their utilisation contribute greatly to environmental destruction. According to the International Energy Agency (2022) estimation, buildings consume nearly 40% of overall energy consumption and 33% of the green gas emissions globally. Sustainable architecture aims to reduce this impact using eco-efficient technology, renewable material, and passive design principles.

Passive solar design, on the other hand, employs natural illumination and ventilation to regulate indoor temperature, limiting reliance on mechanical heating and cooling. Green roofs and vertical gardens decrease heat loss and gain, collect stormwater, and enhance urban biodiversity. Biophilic design, which brings nature into built environments, has been shown to reduce stress and boost productivity.

In rural Africa, for example, the use of sun-dried mud brick and thatch roof construction offers the potential for insulation, low emissions, and in situ local employment. In Europe, retrofitting buildings with new energy technology not only reduces carbon footprints but preserves architectural identity.

Economic Dimension

Sustainable architecture also fosters economic sustainability through job creation, local economy stimulation, and reduction of long-term operational costs. Green buildings usually have a higher

initial cost but over time, this investment pays off in the form of lower energy and water bills, less maintenance and higher resale values (Roodman & Lenssen, 1995).

Affordable housing is another important aspect. With the application of modular construction solutions and techniques, architects can achieve a faster and more affordable building process (Gibb & Isack, 2003; World Bank, 2020). For example, projects like Alejandro Aravena's Incremental Housing in Chile empower families to expand their homes gradually. This approach ensures cost levels and keeps autonomy and dignity in the balance (Aravena & Iacobelli, 2013).

By engaging public-private partnerships, sustainable infrastructure on a larger scale such as solar-powered schools, low-carbon hospitals, and community libraries made with local materials can be financed. Such investment projects ideally not only fulfil social processes but also create economic value through increased human capital and local entrepreneurship (UNECE, 2016).

Social Dimension

Architecture directly influences how people can relate to one another, create communities, and access services. Properly and well thought designed buildings can improve health, social equity, and inclusion. When improperly designed, they can bring about isolation, exclusion, or even danger.

The concept of Universal Design guarantees that the buildings are accessible to people regardless of age and/or abilities. This makes use of well-known features as ramps, handrails, elevators, and clear signage, this also includes sensory-friendly lighting and acoustics (Story, Mueller, & Mace, 1998).

The functions of public places (parks, plazas, markets) can be referred to as a network of social junctions where people meet, have fun, spend free time, and take part in democratic processes. Many African cities have informal markets which serve as not only economic hubs but also social and cultural centers. A plan to design them in such a way that they are safe, clean, and friendly can make the residents be more socially resilient (UN-Habitat, 2010).

Community facilities such as schools, clinics, community halls, are physical representations of social commitment. They must be designed to reflect local culture, be comfortable, and maintain users' dignity (Duffy, 2008).

Cultural Integration In Architecture

Architecture is truly sustainable when it integrates local culture through symbolism, material, spatial arrangements, or process. This is especially important in regions where colonial or modernist paradigms have disrupted indigenous spatial practices.

The use of indigenous design for new construction refurbishes traditional means but renders them suitable for the needs of modern usage. Nigerian architects like Demas Nwoko have successfully merged Yoruba spatial intellect with demands for performance and show in the present era (Uduku, 2006). In India, structures by Laurie Baker are famous because they include India's climate, materials, and cultural forms in their designs (Lang, 2002).

Preserving old buildings through adaptive reuse extends their life and embeds memory in the site. Reusing a colonial house as a community museum or a factory as a cultural center interweaves past and future in a sustainable continuum (Plevoets & Cleempoel, 2011).

Community Participation: A Fundamental Principle

Community engagement is at the heart of cultural sustainability and sustainable development. It reasserts the idea that development ought not to be done for people but by and with them. Participatory processes ensure that built environments represent real needs, desires, and constraints, and are imbued with meanings and values of the served communities.

Participatory design involves local stakeholders at every step, from needs assessment and planning to implementation and maintenance. This enables a sense of ownership that provokes care, stewardship, and sustainability in the long term.

Participation also brings about inclusivity. If women, people with disabilities, indigenous populations, and the youth are incorporated in the planning process, then the built environment becomes a vibrant multi-coloured mural of different capacities and needs. Participation tools (co-design workshops, charrettes and community mapping) also to a great extent conduct genuine public participation. They are inclined to produce solutions that the specialists had not noticed. Finally, participatory planning most explicitly leans on the support of culture. It legitimates local knowledge, ritual, and aesthetics as equal design inputs. It turns architecture into a collaborative effort, whereby professional expertise crosses paths with local wisdom.

Findings And Discussion

The findings of this study are based on a synthesis of secondary data, field examples, and existing literature on culturally responsive design, sustainability practices, and participatory planning. The results show that integrating culture into the sustainability framework—especially through architecture produces measurable environmental, economic, social, and cultural benefits.

In terms of Environmental Impact, research by the International Energy Agency (2022) shows that buildings using traditional, locally sourced materials such as sun-dried mud bricks and thatch can reduce energy consumption by 30% compared to modern concrete structures. These materials not only require less embodied energy but also perform better under local climatic conditions.

For Economic Viability, Hamdi (2004) and Sanoff (2000) highlight that participatory construction methods and the use of vernacular materials significantly reduce construction costs by as much as 25%. They also generate employment for local artisans and builders, reinforcing community economies and reducing dependency on external contractors.

Social Inclusion and Equity: Participatory design fosters ownership, cohesion, and inclusivity. In Medellín, Colombia, crime rates in low-income neighbourhoods dropped by 40% following the introduction of community-designed public spaces (Hamdi, 2004). Similar results were observed in informal settlements in Nairobi, where participatory infrastructure projects led to increased safety and communal pride (UN-Habitat, 2015).

Cultural Identity and Expression: Case studies from Kenya, Nigeria, and India show that architecture reflecting local traditions, rituals, and spatial organization resonates deeply with users. In the Mukuru slums of Nairobi, collaborative design of walkways, drainage, and community spaces reflected cultural aesthetics and functionality, leading to better maintenance and long-term use (UN-Habitat, 2015).

These findings affirm that culture is not an abstract or symbolic dimension, but a practical and measurable asset in achieving sustainable development goals.

Conclusion

The sustainability of our societies, economies, and ecosystems cannot rest on material considerations alone. Even if the economic, environmental, and social pillars provide the essential structure, they themselves are devoid of the thread that links them to human values, identity, and meaning. That thread is culture. The culture, as evidenced in the paper, serves as the lens through which people view, adjust, and maintain the concept of sustainability throughout the years.

Being the result and process of the culture in the broadest sense, architecture represents a harmonious opportunity for the integration of the various pillars. Architecture, when it is inclusive, takes into account the context and is participatory, is a place where sustainability is not just an idea

but also a way of life. It is the stage where environmental ethics, social equity, economic prudence, and cultural expression come together.

Inclusion of culture as a fourth pillar realises the goal of sustainability, which is not only efficient and equitable, but pertinent, beautiful and emerges from the lived experiences of communities. The development of sustainability in the future is not only about abstract calculations but also the down to earth realities of place, memory and meaning.

This paper set out to explore the integration of culture as a fourth pillar of sustainable development, focusing particularly on the role of architecture and community participation. The findings reveal that when sustainability is approached through a culturally grounded lens, development initiatives become more adaptive, inclusive, and durable. Culture serves as a bridge that ties economic viability, social justice, and environmental stewardship into coherent, context-sensitive solutions.

Recommendations

Policy Integration and Development at national and local levels should explicitly incorporate cultural sustainability metrics such as community participation rates, use of local materials, and preservation of heritage.

Architectural Practice and Education, Architecture curricula and professional practice should emphasize vernacular methods, participatory planning, and the cultural context of design. Governments and development agencies should offer funding and incentives such as grants and tax incentives for projects that prioritize cultural sustainability through adaptive reuse, participatory methods, and the inclusion of indigenous knowledge.

Sustainability frameworks should expand to include indicators that assess cultural relevance, community satisfaction, and long-term stewardship of built environments for monitoring and evaluation.

In conclusion, culture must be treated not as an afterthought in sustainable development, but as a foundational principle that informs design, governance, and implementation. Only then can sustainability be truly holistic and transformative.

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AN APPRAISAL OF THE ARCHITECTURE CAREER OF SIR NORMAN FOSTER

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Abstract
Modernism is a philosophical movement that began during the late 19th and early 20th century as a result of cultural trends and changes in western society. Modern architecture was as a milestone in the history of Western architecture, because for the first time, the attitude of the tradition, history and past changed its direction as a source of inspiration of architecture and future and development were introduced as main objective and subject of architecture. Many projects of the modernist era were initially successful, and the public came to associate this strong aesthetic with prosperity and progress. In the post war era (WORLD WAR II), the ambitions of the modernists and their "strong sense of social responsibility in that architecture should raise the living conditions of the masses." seemed so progressive and promising that it was understandable the Architectural Review should herald the movement as the style of the century. A celebration of Modernist architecture in Britain; a collection of fifty illustrated profiles of some of the best Modernist buildings in Great Britain and Northern Ireland. British architecture embraced Modernist architecture, a style which had evolved in Continental Europe, during the inter-war period between the two World Wars. Modernism in its most general sense is a term that applies to all modern architecture of the twentieth century. The architect that promote modernism in Britain during this era are; Richard George Roger, Norman Foster and Sir Ove Nyquist Arup. This research will specifically talk about Norman Foster's architecture and how he reflects modernism in his architecture. One of his building was used for this research; Sainsbury Centre for Visual art in Norwich was used as a case study to evaluate the modernism architecture movement in Britain.

Keyword: Modernism, Modern Architecture, Norman Foster, Britain Architecture, Sainsbury Visual Centre

Introduction

Architecture determines the facts or superior values as associate art works and architecture. Architecture offers visual expression of design concepts. Architecture create significant something for human, as a result of the organize design fact. Architecture as a creative art represents the culture and civilization of a nation and race. So, we need somehow to review their architectural design for a full understanding of humanity and his/her opinions, whether within the past or present. There's little doubt within the importance of architecture and its advantages and its efficiency. However, with the arrival modernism in architecture, special amendment was created within the architecture and created changes in different arts and even in human thinking. With the arrival of this style of design will now not define a special feature for various architectures and somehow brought uniformity in architecture.

In today's field of design, the first concepts of rationalism came back to 17s century. Along with this era theoretical writings, it is possible to understand the notion of using primary geometric forms; cubes, prisms, cylinders, pyramids, and cones. Thus, at this time architectural language was reduced to these basic rational geometric forms, and typologies. This language of design has been called as rationalism, which was discussed as the aspiration for the modernism (Robert, L. 2020).

By the end of 19s century and early 20s century the modern architecture movement, has been introduced. At that time, Le Corbusier recognized the beauty of purity, simple primary geometric forms and explained his ideas based on them. These geometric forms are the major primary ones in the modern language design. Their images are understandable without giving a complication, hereby they are felt as beautiful; that everyone accepts them (Spurr, 2022). Indeed, it can be said that the 'box' shapes are one of the most important starting points in the field of architecture. It continues today as these simple rational forms of human mind. It can be interpreted that modernism defines by purity, simplicity, rationality and functionality.

This research paper aims to assess modern architecture, history and the movement of modernism in architectural history in British. The reflections of the modernism in British architecture and the architects that take the modern architecture movement whereby Norman foster is one of them. Furthermore, highlighting the practical application of the modernist theory in Norman Fosters architecture and assessing the reflection of the modernism in his design solutions and architecture. This paper mainly takes modernism as the research scope in modern era. The Modern movement is divided in regions whereby there are; the American modernism most known as the "Chicago High Rise", the "German Engineering", "British Renaissance", and also in Asia popularly known as "The Post-Metabolism". Based on these movements in different regions across the globe, British Renaissance is focused in this research paper. During the British renaissance, there are different engineers and architects that did promote modernism in Britain, One of such architects is Norman Robert Foster, which also this research scoped down to his architecture.

Modernism In Architecture

Modernism is an international design and style movement that emerged during the Twenties as a response to accelerated industrialisation and social changes. Following 'order' and 'universals' in design. Modernism used new materials and advanced technology and rejected, ancient, historical concepts and designs, and ornamentation. Modernism emphasised function, simplicity, and rationality, and created new styles of expression with a brand new aesthetic (Robert, L. 2018).
This new aesthetic resulted in modern buildings that are characterised by clean lines, easy geometric shapes, pure cubical forms, ribbon windows, flat roofs, and useful, versatile open interior spaces with plain exposed structures that were thought-about applicable for all nations and cultures.
It has additionally been known as International Modern or International style, when an exhibition of modernist architecture in America in 1932 by Philip Johnson was held. Modernism also encompasses Futurism, Constructivism, and Bauhaus design. Modernism is characterised by:

1. Asymmetrical compositions
2. Use of general cubical or cylindrical shapes

3. Flat roofs
4. Use of concrete
5. Metal and glass frameworks typically leading to large windows in horizontal bands
6. An absence of ornament or mouldings
7. A tendency for white or cream

Plans would be loosely organized, typically with open-plan interiors. Walter Gropius (1883-1969) and Le Corbusier (1887-1965) were the leaders of the movement. The latter had a profound impact in Britain, notably after World War 2, with several housing development schemes (Robert, L. 2018). In Britain the term modern Movement was used to describe the rigorous Modernist styles of the Nineteen Thirties to the first Nineteen Sixties, and they describe modern buildings as:

i. Rectangular or cubical shapes
ii. Minimal or no ornamentation
iii. Steel and or concrete
iv. Large windows
v. Open plan

Modernity Abide

Modern architecture was as a milestone in the history of Western architecture, because for the first time, the attitude of the tradition, history and past changed its direction as a source of inspiration of architecture and future and development were introduced as main objective and subject of architecture. Architects and theorists tried to make homogeneous the architecture as a science and technology with evolving world (Amiri N, 2016). Modern architecture emerged in the form of global style, the style that took root after the First World War (from1940) and spread in the reconstruction of Europe after the Second World War (from 1960). This style had its claim to reform architectural process and building design with abandon the no planning and traditional management through the adoption of a global system of architecture (Robert, L. 2018). This new architecture was organized with the norms of rational and used of one of the most efficient materials such as concrete, steel and glass (Amiri N, 2016).

Modern architecture is divided into three periods: Early Modernism (roughly 1890s-1930s), High Modernism (1930s-1960s), and Late Modernism (1960s onwards). However, in its early modernism, it is divided in to three; Chicago movement, art movement and the movement of Futurism styles. supreme modern architecture, or the top of modern architecture was formed between the two World Wars 1 and 2, means mainly in the twenties and thirties AD in Europe and in the early modern period still historicist styles such as Neo classical, romantic and especially eclectic had important as the popular and common styles in the west. One of the key and very important issues was the issue of industry, industrious production and technology in the excellence modern era (Amiri N, 2016). Le-Corbusier considered the use of steel girders and concrete and prefabricated, as the path of the future architecture and knows the pre-fabricating and high-rise making as only solution of future cities. Later modern architecture can be considered after World War II to the early 70's (Amiri N, 2016).

Features Of Modern Architecture

Modern architecture focuses first and foremost on the efficiency and pragmatism and uses the style and tools that has not had a history of such use to this size and in a way tries to develop in the modern era and uses all possibilities to achieve this purpose (Amiri N, 2016). This use causes to restrict the human role in its creating and whether causes to superior the technology on human. This goal is possible better that is with the lowest cost and highest performance and the best way is that we resort to technology and scientific estimates. Modern architecture at the same time, has a holistic mode, means due to the fact that buildings are built in industrial way finds breadth and comprehensiveness and is not for the unique of a person or a particular style (Robert, L. 2018).

This architectural style acts to meet the needs and because it uses a single form is the anti-decorated, anti-show, anti-metaphor, anti-historical, anti-remembering and anti-humour and the meaning has been lost in this architectural style in a way (Amiri N, 2016).

British Renaissance (Modern Architecture Movement)

The British Renaissance, a term often used in the context of architecture, refers to the English Renaissance, which is a period of architectural history and cultural revival in England that occurred during the late 15th to early 17th centuries. It's characterized by the adoption of Renaissance architectural principles, particularly from Italy, and their fusion with existing English architectural traditions. British Renaissance was a period distinct from modern architecture, it's important to note that it paved the way for some of the principles that later became prominent in modernism. The Renaissance's emphasis on symmetry, proportion, and balance in design laid a foundation for the functional and minimalist approach that characterized modern architecture.

The English Renaissance, often referred to as "the Elizabethan era", created an immense stimulation in the arts, literature, music, and architecture throughout all of England. Next to the arts and literature, architecture proved to be one of the most distinguishing aspects of the English Renaissance. Many new styles of architecture, as well as architects emerged during this period, becoming known throughout time.

During the era of the modernism in Britain, there are some group of architects that contribute and, in many ways, did for British engineering and architecture. These architect are as follows;

i. Richard Gorge Roger
ii. Norman Robert Foster
iii. Sir Ove Nyquist Arup
iv. Berthold Lubetkin
v. Maxwell Fry
vi. Walter Gropius

Ove Arup in many ways did for British engineering and architectural thought. He was born in England to Scandinavian parents, educated in Denmark and Germany, and returned to England to open his first engineering office in 1923 (Mallgrave and Goodman, 2012). In the early 1930s he drew close to a circle of modernists that included Berthold Lubetkin, Maxwell Fry, and Walter Gropius, for whom he provided the structural design for the ramps of the Penguin Pool at the London Zoo (1933–1934) as well as the concrete flats of Highpoint I and II (1933–1934). After the war, in 1949, Ove reformed the Arup Partnership, but what gained him international prominence was his later involvement with the Sydney Opera House (Mallgrave and Goodman, 2012). The architectural competition was won in 1957 in a dramatic way by Jørn Utzon but with a design that was flawed in its execution. Design delays and cost overruns nearly scuttled the project until – in 1961 – Arup reconfigured the roof shells to one and the same radius. Although the attribution of this idea to Arup remains contested, no one disputes Arup's role in bringing the intricate work to a successful conclusion after Utzon resigned from the project in 1966. When the Opera was completed in 1973, Arup's firm, now also enlarged with an architectural division, was a rival to SOM in both staff and influence (Mallgrave and Goodman, 2012).

Arup's global accomplishments also inform the work of Richard Rogers and Norman Foster. Rogers, the elder by two years, was born in Florence in 1933 to a British father and Italian mother, and the family later immigrated to England under the pressures of the unfolding war (Mallgrave and Goodman, 2012). With the encouragement of his cousin Ernesto Rogers, Richard attended the Architectural Association in the mid-1950s and in 1961 he won a traveling fellowship to Yale. It was there that he met Foster, who had recently completed his architectural studies at Manchester University. The two students studied under Paul Rudolph (for whom Foster briefly worked), Serge Chermayeff, Vincent Scully, and the visiting critic James Stirling. In the United States, Foster and Rogers were attracted to the ideas of Buckminster Fuller and the work of Louis Kahn, Eero Saarinen, Frank Lloyd Wright, and the Case Study architects (Mallgrave and Goodman, 2012).

Back in London in 1963, Rogers and Foster, together with Wendy and Georgia Cheesman, formed up a partnership known as Team 4 (British Architecture Firm). Two early commissions, Creek Vean House, in Cornwall (1964–1966), and Skybreak House, Hertfordshire (1965–1966), are transitional designs within the careers of both men. The terraced forms and concrete-block finishes of the former have often been attributed to the influence of Wright and Atelier 5, while the cinematic open-plan and high-modern interiors of the latter prompted Stanley Kubrick to use it to film one of the rape scenes of A Clockwork Orange (Mallgrave and Goodman, 2012). The defining commission for both men, however, was Reliance Controls in Swindon (1965–1966), an electronic factory, where they began mastering the nuances of industrial detailing – in the tradition of the Case Study architects of California. Designed on a very limited budget, the lightweight, corrugated steel shed was detailed in a minimalist vein. Both men thus embraced naked technology and a coolly efficient style of engineering, but the partners split up after the project's completion (Mallgrave and Goodman, 2012).

Norman Robert Foster

Sir Norman Foster is a prominent and prolific British architect known for his innovative, stylish structural designs, as seen with edifices like Berlin's Reichstag, New York City's Hearst Tower and London's City Hall.

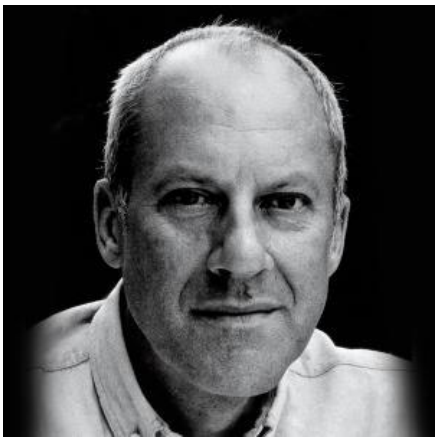

Figure 1: Norman Robert Foster
Source: https://cdn20.pamono.com/l/m/2016/06/0000056514-1144x1144/norman-foster.jpg

Born in 1935 in Manchester, England, Sir Norman Foster is an award-winning and prolific British architect known for sleek, modern designs of steel and glass with innovations in contouring and inner space management. He was part of the architectural group Team 4 before branching off on his own to form what would eventually be known as Foster + Partners. Foster earned acclaim for his design of the Willis Faber & Dumas headquarters in the early '70s and was later responsible for the updated Reichstag in Berlin after the reunification of Germany as well as the Hearst Tower in New York City. His design practice has overseen an array of heralded structures around the globe.
He went on to study architecture at the University of Manchester and won accolades for his drawing work, developing a lifelong passion for sketching. He later earned a scholarship to Yale University's School of Architecture, earning his master's in 1962.

While at Yale, Foster met Richard Rogers, with the two eventually becoming part of the architecture world's elite. In 1963, Foster, along with Richard and Su Rogers, his future wife Wendy Cheesman and her sister Georgina Wolton, formed the architectural organization Team 4. Foster broke off on his own in 1967 to form Foster Associates, which would later become Foster + Partners.
In the early 1970s, Foster had his big break with the design of the Willis Faber & Dumas headquarters in Ipswich, a low-rise office building that was innovative for its use of escalators, contoured facades and idyllic, nature-oriented interiors. The late '70s and early-to-mid- '80s saw Foster and his team working on the Hong Kong and Shanghai Banking Corporation headquarters, a modern three-tower edifice, while the '90s saw the architect heading up an update of the Reichstag in Berlin, rebuilding the emblematic glass dome after the unification of East and West Germany. In

the early 2000s, Foster also contributed to the iconic New York City skyline with his design of the Hearst Tower, a 44-story skyscraper with a triangulated facade atop an Art Deco foundation.

Figure 2: Willis Faber and Dumas Headquarters, Ipswich, United
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Figure 3: Honk Kong HSBC Building.
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Figure 4: Hearst Tower in New York
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Other renowned Foster-designed structures include the Sainsbury Centre for Visual Arts in Norwich, Kuala Lumpur's Troika Towers, Frankfurt's Commerzbank, Hong Kong International Airport and London's City Hall and Millennium Bridge. (The latter structure, which utilized lateral suspension techniques, underwent repairs days after its inauguration by Queen Elizabeth, to rectify wobbliness caused by heavy foot traffic.) The Millennium Bridge is London's first dedicated pedestrian bridge and has become a new landmark of the 21st century.

Figure 5: Sainsbury Centre for Visual Arts in Norwich.
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Figure 6: Commerzbank Tower-1997-Frankfurt, Germany
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Figure 7: London City Hall Building
Source: https://www.fosterandpartners.com/media/hero.jpg?width=1920&quality=85

Case Study: Sainsbury Centre For Visual Arts In Norwich.

The Sainsbury Centre was constructed through 1977 and opened in 1978. It stands on the edge of the University of East Anglia (UEA) campus, initially developed to the plan and designs of Denys Lasdun within the Nineteen Sixties, and to the west of the Grade II• listed Norfolk and Suffolk Terrace, the listed Teaching Wall and the library to the university. The centre was built in order to store the art collection of Lord and Lady Sainsbury, the founders of the Sainsbury supermarket chain and noted collectors and supporters of the arts. After a successful exhibition in the Netherlands, they approached the UEA Vice Chancellor, Frank This Lewthwaite, who had established the university's School of Fine Arts and Music and donated their collection in 1973. It quickly outgrew its accommodation, and it was clear that a purpose-built home was required. In 1974 Norman Foster met Lord and Lady Sainsbury to discuss the commission and the building work began in 1977. Foster's brief was very specific, based on the Sainsburys' experience of art galleries around the world.

Figure 4: Sainsbury's art centre Norwich
Source: https://www.arch2o.com/wp-content/uploads/2016/01/Arch2O-Sainsbury-Center-for-Visual-Arts-09.jpg

Evaluation

The structural frame is composed of trussed, tubular steel, prismatic latticework, columns and single-span beams, which in series form 36 bays. The frame is clad with sheet aluminum panels and is glazed in part.

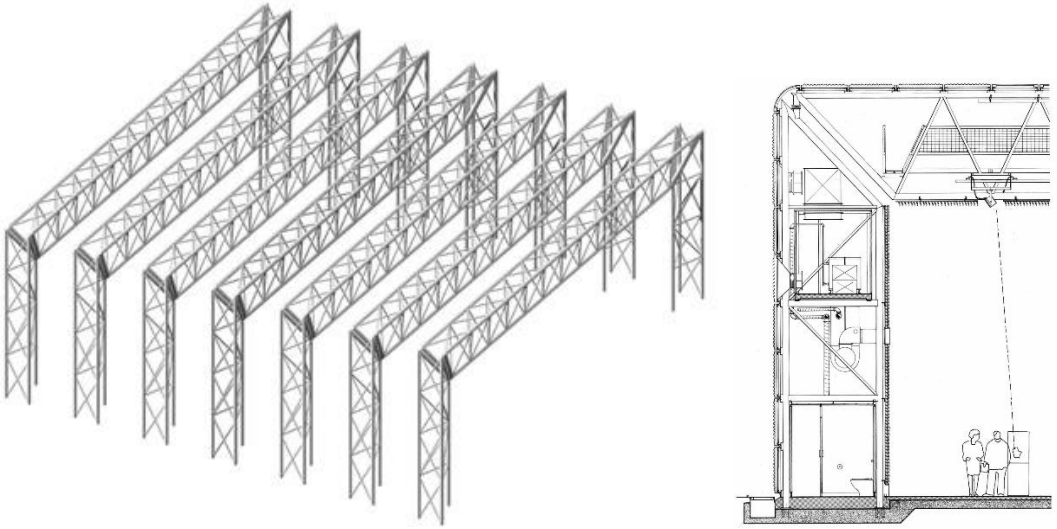

Figure 5: structural framing system
Source: https://www.tboake.com/SSEF1/SAINSBURY/Multi-bay_Sainsbury_Inmos.jpg

Based on the review mention on modern architecture, one of the characteristics of modernism is the use of steel and concrete at the materials of the building. Norman foster uses steel all through as the structure of this building and this masterpiece of design is also known as high tech design. Now taking to heart Fuller's frequently posed question "How much does the building weigh?" (Mallgrave and Goodman, 2012). This was his thought when developing the Sainsbury's Art Centre.

In modernist architecture, the use of large glass opening is one of the significant characteristics and in this case, Norman Foster also integrate this idea by having the high and wide glass façade at the sitting area of the restaurant having an elegant view of the nature from inside; according to Norman Foster is the "is the perfect place to enjoy a light bite and have a nice view" as shown in the figure below;

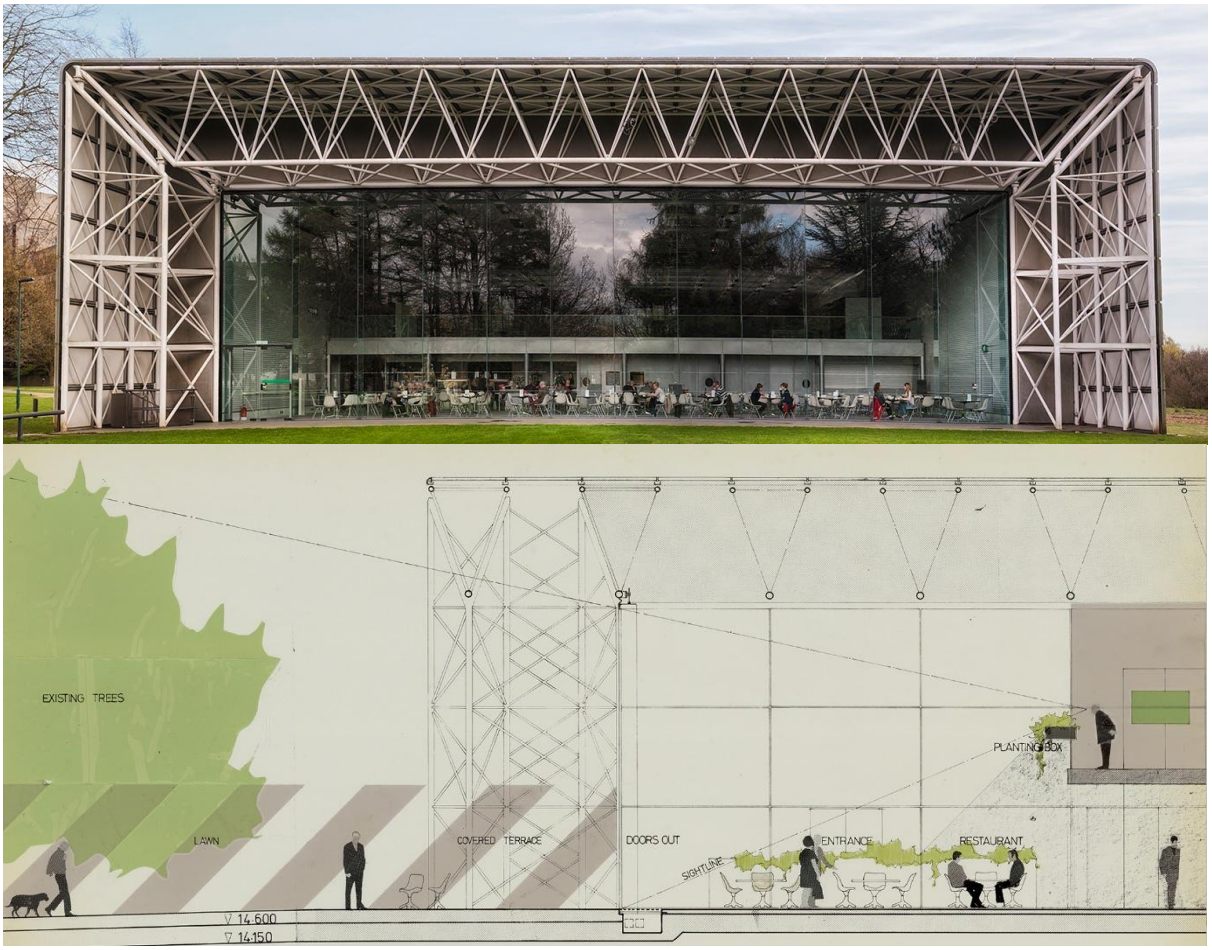

Figure 6: Cafeteria sitting in Sainsbury's art centre
Source: https://portal.uea.ac.uk/documents/6207125/9076228/May+2015-237.jpg/56f603d3-b96e-4b59-b583-c7f60cea8da0?t=1431696937671

The form of the building is rectangular in both plan and section, (one of the main features of modernist architecture is simpler and more rectangular in shape) comprising a single-storey structure over a basement. The columns of this building form the thickness of the walls, and faced on the exterior with simple rectangular panels joint together as the building façade: mainly composite aluminum sheet (Mallgrave and Goodman, 2012) on the two side of the building, but the use of glass for the full height at the two entrance bays on the southwest side of the building, and partially glazed at the curved junction of wall and roof. The glass-paneled areas are pierced by a rectangular arrangement of circular ventilation fans which form a design feature.

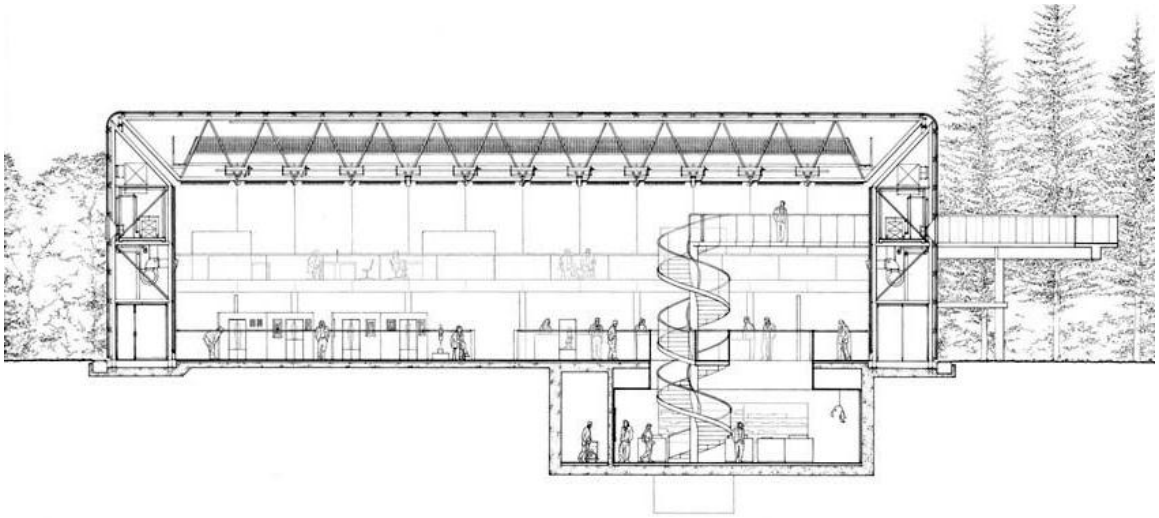

Figure 7: Exterior materials of Sainsbury art centre
Source: **http://c8.alamy.com/comp/K65F5A/exterior-of-the-sainsbury-centre-for-visual-arts-designed-by-norman-K65F5A.jpg**

The exterior aluminum paneling is an indigenous material gotten from the country, advised by the architect Norman foster. The insulated thickness of the walls contains the services, utilities and some storage, while at the end walls are remarkably glazed with a series of innovative, 7.3m high glass panels (which this gives it a modernist architecture), with internal glass fins, sealed with gum. The glazed façade on south-east end compromises a view from the rise of land on which the building sits, down towards the lake, known as the Broad. At each end, the building spreads one bay outside the glazing.

Figure 8: Exterior Materials used
Source: https://www.arch2o.com/wp-content/uploads/2016/01/Arch2O-Sainsbury-Center-for-Visual-Arts-24.jpg

The centre is connected to the Teaching Wall (Listed Grade II) by a raised, ribbon walkway, with glazed sides, which gives access to the north-east side of the Sainsbury Centre at a raised level above the reception area. It delivers visitors to a short internal bridge linking to a metal spiral stair, and thus down to the main floor.

Figure 9: Interior of the main floor
Source: https://www.artfund.org/thumbnail/908/assets/what-to-see/museums-and-galleries/q-s/sainsbury-centre/gallery-interior.jpg

From the inside of Sainsbury art centre, the natural light that comes inside from above, was clarified through four strips of roof-top glazing and is controlled by bands of adaptable blinds at the ceiling level. Light from the walls is controlled by punched louvres at the sides, and blinds (a later addition) at the ends.

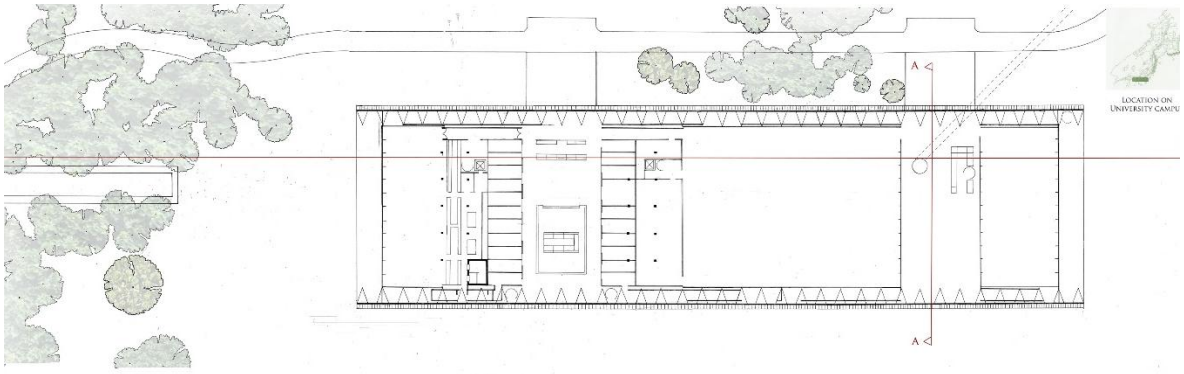

Figure 10: Floor plan of Sainsbury Art Centre
Source: https://en.wikiarquitectura.com/wp-content/uploads/2017/01/Sainsbury_Centre_planta_de_implantaciC3B3n-1024x595.jpg

Norman foster intended the exhibition areas in the building to be flexible, reusable spaces; so the single-span beams (The prismatic-truss hanger spanning 30 × 130 m) and wall housed services are planned to leave the ground floor plan as open as possible (this also features the characteristics of modernist architecture). The floor I the building is divided into six distinctive areas. The south-eastern end forms an exhibition gallery, divided from the central gallery by the reception bay (formed of an entrance lobby on the north-east side, and a café on the south-west).

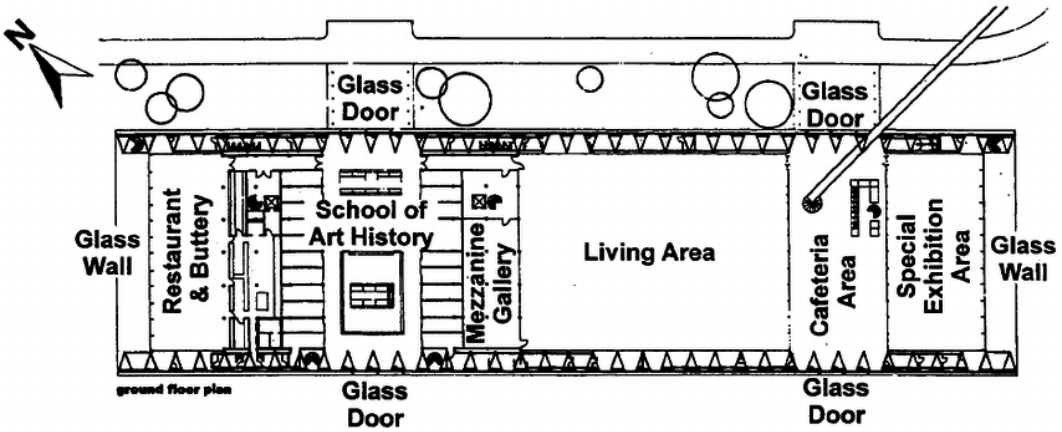

Figure 11: Ground floor plan
Source: https://emilydaisypage.files.wordpress.com/2012/06/plan2.jpg

At the centre is a circular reception desk. The glazed entrance on the north-east side contains two, circular-lobby doorways. Entree to the central exhibition gallery, named as the 'living area', is via a recently situated. In this area, it contains axial and angular, unconnected panels, designed by Norman foster as planes for mounting the artwork gotten from lord and lady Sainsbury. On the north-east side is a glazed entranceway. The two mezzanines form exhibition floors over glazed offices and tutorial rooms beneath and are supported on circular columns sheathed with sheet aluminum, which generally forms the surface finish. The mezzanine levels are reached via metal circular stairs with tubular handrails and glazed panels below (added in 2006), which also give access down to the basement. Access to a restaurant at the north-west end is along the north-east side of the adjacent mezzanine.

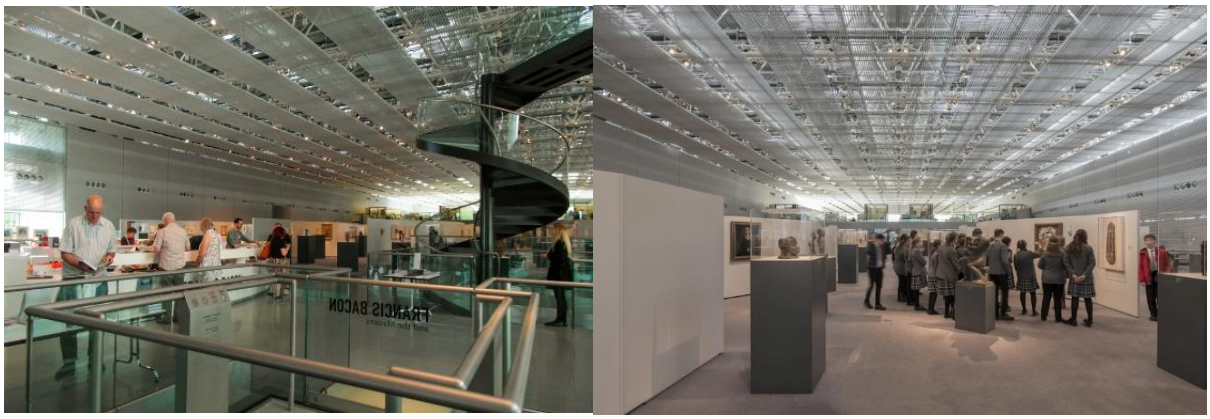

Figure 12: Interior pictures of Sainsbury Art Centre
Source: https://portal.uea.ac.uk/documents/6207125/9076228/May+2015-237.jpg/56f603d3-b96e-4b59-b583-c7f60cea8da0?t=1431696937671

Vehicular access to the basement is via a concrete ramp at the north-west end. The sunken loading bay, grassed on the surface, is screened from the main basement area by folding doors with circular lights. The basement, for workshops in the main, is relatively narrow and runs just off-center down the length of the building. It has a main goods lift and a corridor on the south-west side, which acts also as a cable conduit.

Figure 13: Sainsbury's Art centre basement entrance
Source: https://www.arch2o.com/wp-content/uploads/2016/01/Arch2O-Sainsbury-Center-for-Visual-Arts-23.jpg

Conclusion

In Britain, Modern architecture or modernism movement was promoted by wide group of architects and engineers. Norman Robert Foster is one pioneer architect during this movement practical highlight the Modernism and postmodern architecture in his design and practice. Aside from the fundamental philosophies of Modernist architecture, famously summarized by American architect Louis Sullivan as "*form follows function*," the design and the architectural style has a precise and

identifiable appealing. *The diversified use of cubical and cylindrical shapes informs with flat roofs and the absence of ornamentation create a clean and simplified look related to previous heavily ornamented styles of traditionalism.* As for materials in this style, *the use of metal, glass and exposed concrete* provided Modernist architecture an industrial or practical appearance. A fitting description based on Modernist architecture pioneer Le Corbusier's declaration that a house is *"a machine for living in."* (L. Khan 2013). Stark, neutral colours like white, cream or grey were another mark of Modernist architecture.

During this movement, Architect Norman Foster produce one masterpiece (Sainsbury's Art Centre, Norwich) applying the characteristics of modern and postmodern architecture, and the project is successful.

According to the evaluation done on Norman Foster's Modernism movement in this research paper, the building (Sainsbury's Art Centre) brought a new level of refinement to the practice's early explorations into lightweight architecture and modernism in terms of the following aspect;

1. **Shape;** The shape of Sainsbury Art Centre is cubical in plan section and form. The form is smooth and silky, the structure of the building is also used as beautifully and reviled as an aesthetics: the complete resolution of the flowing surface, the sense of visual inclusion, of togetherness, propriety, good manners are also incorporated in this project. Le Corbusier and Walter Gropius mentioned in an essay "the leading innovators of modern architecture considered it as a volume of space enclosed by light, thin curtain walls and resting on slender piers. The visual aesthetic of modern architecture was largely inspired by the machine and by abstract painting and sculpture". Whereby these characteristics give it a modernist architectural shape.
2. **Materials;** Sainsbury's Art Centre uses metal for it structure, aluminum panel and glass for the building envelope, Which gives it a modern and high-tech architectural outlook.

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LAND USE LAND COVER CHANGES: ITS EFFECT ON FORESTRY AND WOODLOTS IN THREE SELECTED LOCAL GOVERNMENT AREAS OF ADAMAWA STATE, NIGERIA

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Abstract
Forest reserves lands in most Nigerian cities have disturbed, encroached and converted to a different land uses Land cover is changing rapidly over time. This study focused on Maiha, Mubi North and Mubi South local government area of Northern Adamawa state, Nigeria. The Landsat's data from Nov.28,1985 to Nov.30,2015 was obtained. This paper aim at reviewing the effects on forestry and woodlots policy and practice in northern Adamawa state, Nigeria, with a view of making planning recommendations. The objective of this study is to investigate the nature of the forestry, woodlots and plantation for the period of thirty (30) years (1985-2015). A remote sensing images of multi spectral bands of 1985, 2000 and 2015 landsat images were used to identify the forest / sparse trees or vegetation loss and forest land encroachment, The result revealed notable increase and change pattern was observed. The built-up area has change from 101.50km^2 -694.10km^2 that is an increase of 592.6 km^2 or 25.43 percent. At the rate given an impression of increase over the year from 1985-2015. The built-up expansion resulted to loss in natural forest/sparse trees on average rate of 896km^2 – 424.20 km^2 as vegetation represent the most significant change. The losses of natural vegetation also result to increase in bare-surface and farmlands whereas increased in built-up leads to increase in their sizes. On average changes in bare- surface was from 182.10km^2 – 313.30km^2 while that of farmlands occurred by 1.42 km^2 – 518.70 km^2 it's also represented the most significant change in land use and land cover of Maiha, Mubi North and Mubi South local government area from 1985 to 2015. Hence the population to a continual demand for fuel wood, lumbering, construction and farming as the study's area landscape was observed to be changing rapidly in Maiha, Mubi North and Mubi South local government areas of Adamawa state particularly the North-Eastern part of Nigeria. It's recommended that State Ministries of Agriculture and Natural Resources, Forestry Departments, Local Government Councils chairmen and Ministry of Urban Planning to strongly promotes ecological breeding models in the study areas.

Keywords: Land use, land cover, Effect, Forestry, GIS, Remote Sensing, Changes, Detection.

Introduction

The increase in population density, land use dynamics exhibited exponential growth, and the relative changes in land use of woodland, grassland, construction land, and wetlands were directly proportional to the changes in population density (Liu et al, 2022). However, past research generally considered short-term LULC changes, future development planning, and policy formulation (Ciu et al, 2022). LULC changes result from the combined effects of various driving factors, and different factors can lead to changes in LULC (Niu et al, 2022). Urbanization and urban expansion can cause considerable changes in land use/land cover (LULC) patterns, which can impose negative impacts on urban areas, especially on green spaces, farmlands, vegetation cover, and natural environment (Adebayo,2004, and Adekunle, et al, 2009). Man in the bid to meet his basic needs of food, clothing and shelter, exploits the resources of the physical environment which are usually not deliberately replaced (Ba. et al,2014, and Nasiru et al, 2009). Forests and vegetal cover are prominent among such resources. Bin et al, (2023) affirmed that intensely revealing the changes in LULC and their driving mechanisms is fundamental to clarifying the relationship between regional socioeconomic development and ecological environment utilization and protection, which is crucial for exploring the pathways of regional green upgrading development. Growing interest towards achieving a greener environment through tree planting campaign efforts globally, as trees are purported to provide many benefits such as temperature modification, energy conservation, abatement of air, water pollution and as well as a wind breaker (Alberti, 2010 & REDDCELL, 2012). Environmental concern about global warming, urban heat islands, and air pollution has brought attention to the potential of trees to ameliorate climate conserve energy enhanced environmental conduciveness in terms of aesthetics and property value mostly in urban areas or cities (Bellefontaine, et al, 2002). and CPRE, 2015).

Trees and woods are vital to health and well-being. Also, there is a strong relationship between the quality of urban green space and people's health and wellbeing Simula, (2009), In the traditional African setting; trees are part of the visible features of villages and settlements (Herrmanran, et al, 2000). Past and even present deforestation activities in such countries has led to the removal of a large proportion of vegetal cover so much that deliberate steps need now to be taken to forestall further damage to the physical environment (Simula, 2009). At the same time, there is an increase in urbanization in developing countries. Urban centers in such countries are vast area of tar and concrete without the green component of vegetal cover. This loss of green areas can aggravate the urban heat island effect (Souza et al, 2000).

Studying the relationship between LULC changes and influencing factors is crucial for addressing issues related to the land system (Liu et al, 2022). Research indicates that natural elements and economic factors are the primary drivers of LULC changes (Niu et al, 2022). The combination of mathematical and statistical analysis methods these two has become a current research method (Liu et al,2022 & Niu et al 2022), these models can quantify the driving effects of LULC change drivers and have thus been widely applied.

Aim and Objectives of the study

The aim of this study is to review the forestry and woodlots policy and practice in three Local Government Areas of Adamawa state Nigeria with a view of making Planning recommendations.
The following objectives were set for the study:
To examine the policy, strategy and framework of forestry and woodlots practice.
To investigate the changes in forestry, woodlots and plantations areas between the period of 1985-2015 using remote sensing techniques.
To produce and assess the land Use/Land Cover changes map of the Study from (1985-2015).

The Framework of Analysis on Forest Land Disturbance in the Context of Nigerian Cities.

Forest disturbance is a serious environmental, social and economic problem. Quantifying the scale of the problem is difficult, however, because forest disturbance has many causes, occurs in different

forms and with varying intensity, and is perceived differently by different stakeholders (REDDCELL, 2012). The indiscriminate felling of trees has continued in virtually every part of the country. For instance, the Federal Department of Forestry FAO, (2000). estimated that Nigerian forests are being depleted at an annual rate of 3.5%. Nigeria used to have about 20% of its area covered with natural forests but, this has been reduced to about 10%. It lost about 60% of its natural forests to agricultural encroachment, excessive logging and urbanization between the 1960s and the year 2000 (FAO, 2000).

Another major factor contributing to environmental degradation in the country is the uncoordinated land use policy. Natural forests are being destroyed by other forms of land use, like agriculture, grazing and construction activities as a result of rapid urbanization leading to desertification and degradation of the environment (FAO, 2000).

There is evidence of land conversion to agriculture in some forest reserves without any serious effort by the authorities to stop the trend (USAID,2008). Forest disturbance, therefore, has the potential to adversely affect millions of people who depend, wholly or in part, on forest goods and services at a local scale, and billions of people who benefit from forest services at regional or global scale (Dahlin, 2010).

Sound forest management practices have been phased as an interesting strategy to ally forest conservation and rural economic development in the tropics (Patenaude et al,2005). Forest revenue systems were outdated, which tended to treat forest resources as free commodities, and state forestry departments had not been managing forest reserves systematically (Akosim. et al,2009). The increase in human population in Nigeria over the last four Akosim. et al, (2001). decades has resulted in an increase in demand for farmland and livestock grazing and forest resources such as wood for timber, building and energy. This resulted in an enormous pressure on land and wood resources in both protected and unprotected areas with the attendant Consequences of depletion, fragmentation and degradation of forest estate in the region (Akosim. et al,2001).

Over dependence on natural vegetations and improvement in technology of tree felling and transportation have eased access to, excessive cutting down of trees, nonetheless, is a primary source of livelihood as well as driven of changes with far reaching multiplier impact in the region and beyond (Ba. et al,2014). Tukur and Adebayo (1998). affirmed that modern means of transportation has made it possible for Yola to get 60% of its fuel-wood supplies from outside its immediate hinter land and it's also applicable to Maiha, Mubi North and Mubi South. The biodiversity of Nigeria contains a number of native species, like bush mangos and oil palms, as well as a number of plants with medicinal uses and many more useful plants that are yet to be scientifically discovered and utilized. Likewise, the chemical compounds produced by amphibians, insects, and a myriad of other species in Nigeria may one day be found to have important uses in agriculture, medicine, and other applications (Sabogel,2006).Modern notions of heritage conservation recognize the need for the integration of three interrelated objectives for urban conservation: physical, spatial and social (Ilesanmi,1999).

The strategy of incorporating tree-planting, habitat enhancement, and climate mitigation programs all within the context of supporting ecological services. Its improve community access to food, promote involvement and the Green print suggests food growing techniques, guidelines (Ilesanmi,1999).

Application of Remote Sensing and GIS on Forest Land Disturbance

Detection and mapping of forest disturbance with optical remotely sensed data is more challenging than mapping forest conversion due to deforestation because disturbed forest 'pixels 'are complex environments with mixtures of different land cover materials (i.e., vegetation, dead trees, bark, tree branches, soil, shade) (Souza and Robert, 2005). A detailed review of the available methods to detect and map forest disturbance is provided elsewhere. Several remote sensing techniques have been

used to characterize forest disturbance in the Brazilian Amazon. High spatial resolution sensors, such as Landsat (30m) and SPOT (20m) are the ones most used (Patenaude et al, 2005). The studies in the Brazilian Amazon have shown that Landsat reflectance data have limited capacity for detecting logged forests, with bands 3 and 5 providing the best spectral contrast between logged and intact forests (Souza and Robert, 2005). Vegetation indices and texture filters also showed some potential for detection of logging impacts (Asner,2001). A recent study demonstrated that textural filters applied to Landsat band 5 can enhance detection of logging infrastructure (i.e., roads and Log landings) (Manandhar, 2009).

Materials and Methods

Study Area

The study area covers Maiha, Mubi North and Mubi South Local Government Areas of Mubi Region. All the Local Government Areas are located adjacent to each other. They are located approximately between latitudes 09^{0}48'29"N and 11^{0}21'47"N of the equator and longitudes 12^{0}43'18"E and 13^{0}32'33"E of Greenwich meridian which it lies on the altitude 731 meter above sea level. The study area comprises three (3) local govt. areas, eleven (12) administrative Districts and their Headquarters and a total number of two hundred and seventy (270) rural settlements with 391,224 habitants over an area of 5,965.77 (2,329.80) km^2 (Adebayo,2004, and Adekunle, et al, 2009).

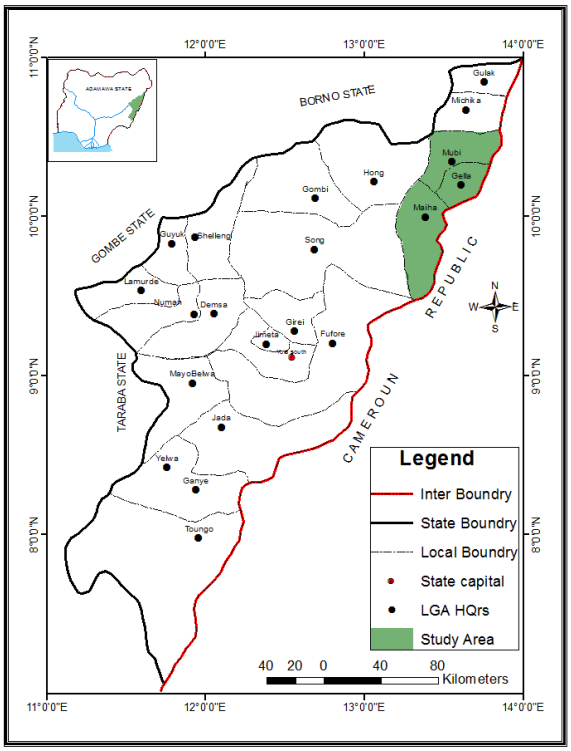


Figure 1:Map of Adamawa State Showing Study Areas

Source: GIS Laboratory, Geography Department MAUTECH Yola 2017

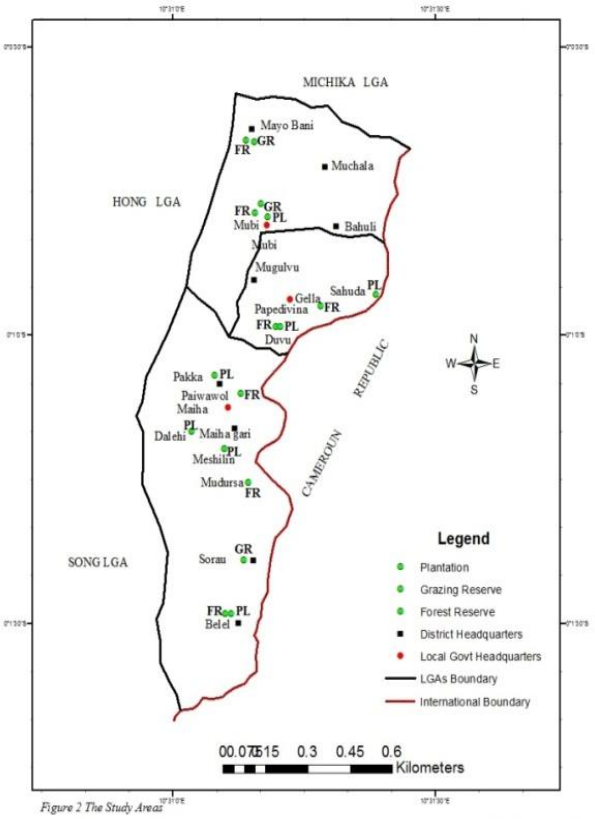


Figure 2 The Study Areas

Source: Adamawa in map, Geographical Synthesis, GIS Laboratory, Geography Department MAUTECH Yola 2017

Methods

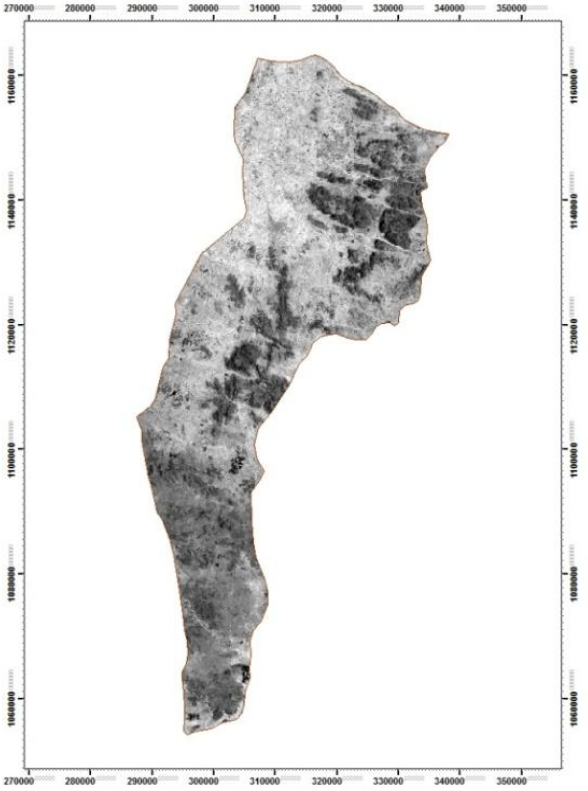
The Secondary Satellite data are collected from United States Geological Surveys (USGS).

Table 1. Data Acquisition and Sources

Data	Source	Date of Acquisition	Characteristics
Landsat-TM.	USGS.	28November, 1985.	Spatial
Landsat-ETM+.	USGS.	29November, 2000.	Spatial

Landsat-OLI.	USGS.	30November, 2015	Spatial
Ancillary data: Field data &Maps.	Maiha, Mubi North & Mubi South forest and woodlots, ADSMLS, Adamawa in map		Spatial /Non-Spatial
Software.	ArcGIS-9.0, ArcGIS-10.0 /10.1 and Google Earth.		

A: Landsat TM Nov 28, 1985,



B: Landsat ETM+ Nov 29, 2000

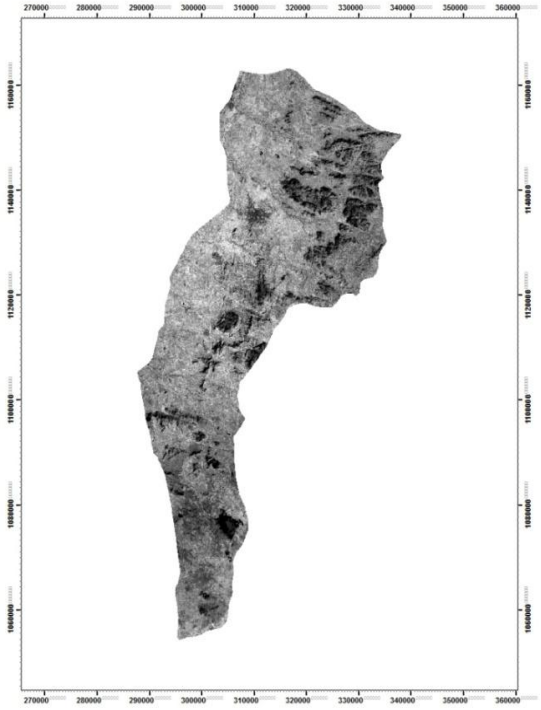


Plate A, B and C: Landsat Images of the Study Area Used in the Research.

Table 2. Main Characteristics of the Imageries used in the Study

Instruments	**TM**	**ETM+**	**OIL TIR**
Landsat	Landsat5	Landsat7	Landsat8
Acquisition Date	November 28, 1985	November29, 2000	November 30, 2015
Path/Row No.	185/53	185/53	185/53
Spectral band(m)	Bands7 1 0.45-0.52 Blue 2 0.52-0.60 Green 3 0.63-0.69 Red 4 0.76-0.90 NIR 5 1.55-1.75 NIR 6 10.4-12.5 Thermal 7 2.08-2.35 MIR	Bands 8 1 0.45-0.52 Blue 2 0.52-0.60 Green 3 0.63-0.69 Red 4 0.76-0.90 NIR 5 1.55-1.75 NIR 6 10.4-12.5 Thermal 7 2.08-2.35 MIR 8 panchromatic -Optical bands -Thermal band -Panchromatic	Bands 11 1 0.45-0.52 Blue 2 0.52-0.60 Green 3 0.63-0.69 Red 4 0.76-0.90 NIR 5 1.55-1.75 NIR 6 10.4-12.5 Thermal 7 2.08-2.35 MIR 8 panchromatic 9 $SWIRI_1$ 10 $SWIRI_2$ 11 Optical bands -Thermal band -Panchromatic
Ground Resolution	30m*30m	30m*30m	30m*30m

Source: Compiled from the header files of various Landsat Images and United States Geological Surveys Data Archive (earthexplorer.usgs.gov)

Global Positioning System, Field Observation and Ground Truthing.

An intensive field survey was performed throughout Maiha, Mubi North and Mubi South local government areas using both Google image and Global Positioning System (GPS) equipment. A Garmin 60XS hand-held GPS is an efficient GIS data collection tools which allows for users to compile their own datasets directly from the field as part of 'ground truthing 'to determine the components of the classified satellite imageries. The field survey was conducted in order to obtain accurate

location for land use and land cover class, same method was applied for all other land use and land cover types.

The data were analyzed using the following steps, including identification of the study area, data collection, image pre-processing, supervised classification, data analysis, and change detection. The procedure of changing detection of Land Use Land Cover analysis in Maiha, Mubi North and Mubi South Local Government Areas for the period of 30 years from (1985 to 2015)

Table 3; Location and Coordinates of Training Samples used

Locations	**Northern**	**Eastern**
Duvu Bridge/ Mountain forest	3^0 15' 95"	12^0 09' 40"
Fishery Dept. ADSU	3^0 11' 78"	13^0 76' 06"
Gella, Kwaja Junction	3^0 14' 17"	12^0 16' 02"
Mudursa forest Reserve	2^0 99' 12"	11^0 60' 89"
Paiwawol forest Reserve	2^0 95' 33"	11^0 60' 76"
Shuware GDSS Playground	3^0 10' 97"	13^0 65' 69"

Source: Field Survey 2016

Plate A: Duvu – Gella Bridge /Mountain Forest

Plate B: Fishery Department in ADSU Mubi

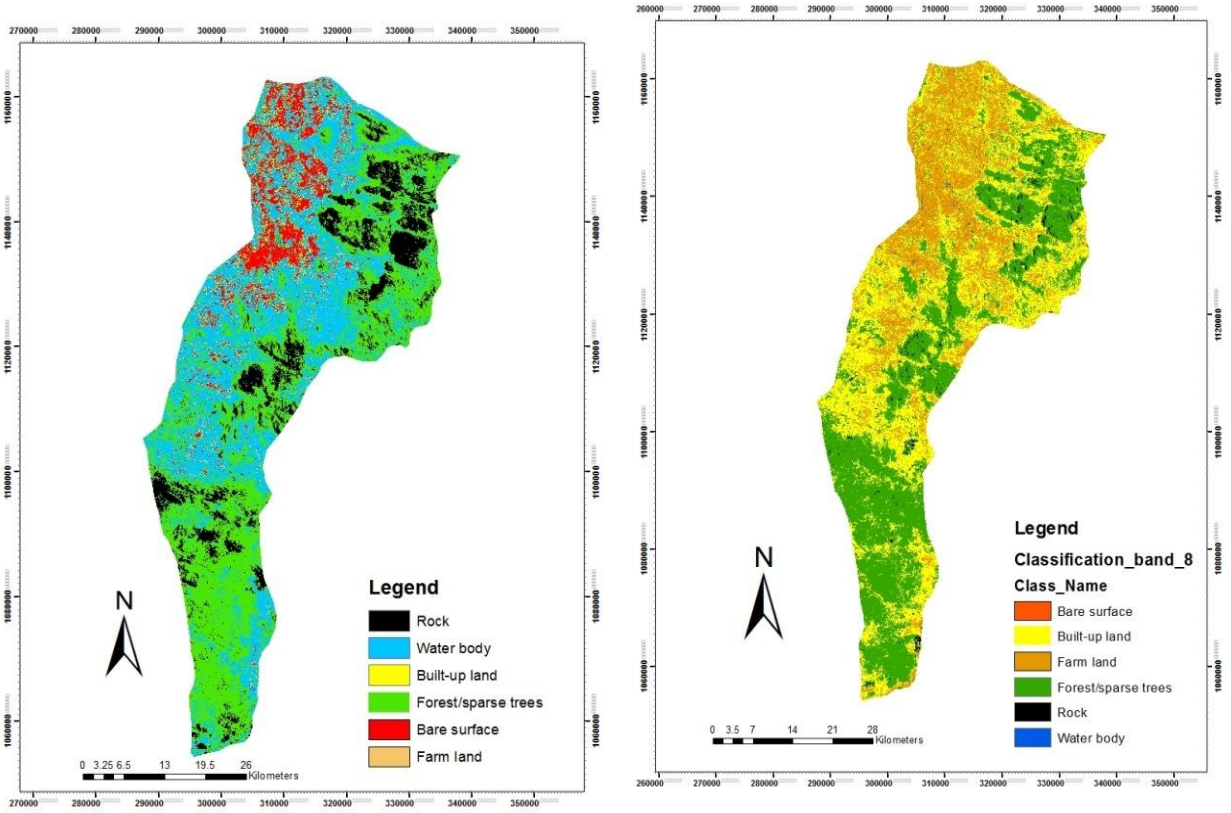
Plate C: Gella – Kwaja Evidence Deforestation in Mudursa Forest Reserve

Plate D: Evidence of Deforestation in Mudursa Forest Reserve

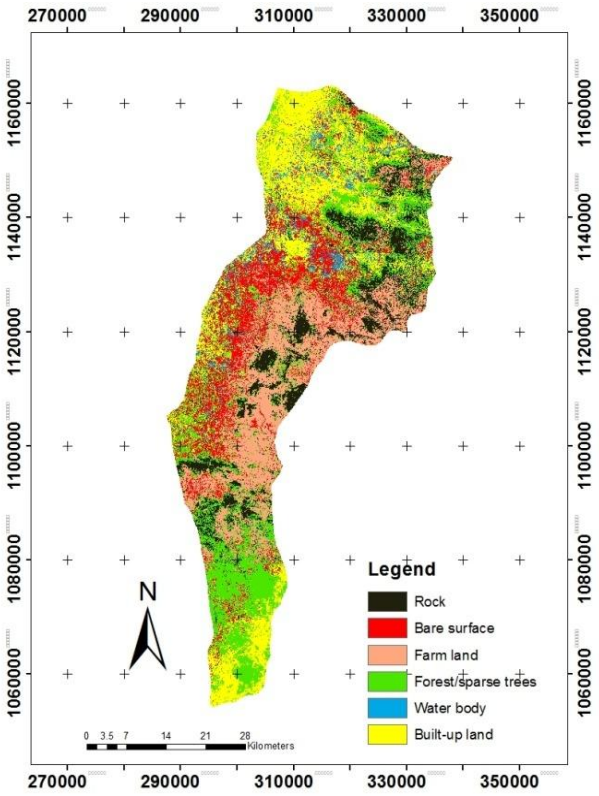
Plate E: Shuware Garden City GDSS Playground

Plate F: Pawawol Forest Reserve

Image Analysis



A: Classified Landsat Image TM 1985 **B: Classified Landsat Image ETM 2000**



C: Classified Landsat Image OLI, 2015
Plates A, B and C: Classified Landsat Images of the Study Area Used

Results and Discussions

Change Detection of 1985 to 2015

After classifying the three maps for each year it was then analyzed to quantify the changes over the period of fifteen (15) years each from (1985-2000-2015) and that of thirty (30) years (1985 -2015). The changes in the land use/land cover classification of Maiha, Mubi North and Mubi South LGAs revealed that in 1985-2015 forest /sparse trees accounted for about 38.46% drastically decreased to 18.22% of the total land area. Built-up area in 1985-2015 there was a significant increased from 4.36% to about 29.79% of the total land area. Water body was accounted about 36.19% decrease to 7.59% in 1985-2015, Rocks from the analysis carried out revealed a decrease from 12.57% in 1985 to 8.70% in 2015, and this would have been probably as a result of climatic conditions and weathering, while Bare surface from the classification in 1985 also witness increase from 7.82% to 13.44% in 2015. Lastly, Farmland in 1985-2015 was undergone increase as a result of anthropogenic from 0.60% to 22.26% of the total land area. (See table 2 below).

Table 4: Statistics of changes in land use / cover between 1985 to 2015

	1985		**2015**		**Changes between 1985-2015**		
LAND COVER CLASS	Area (km^2)	Area (%)	Area (km^2)	Area (%)	Area (Km^2)	Area (%)	OBSERVATION
Rock	292.70	12.57	202.70	8.70	90.00	3.87	DECREASE
Water body	843.30	36.19	176.80	7.59	666.50	28.60	DECREASE
Built-Up Area	101.50	4.36	694.10	29.79	-592.90	-25.43	INCREASE
Forest/Sparse Trees	896.00	38.46	424.20	18.22	471.80	20.24	DECREASE
Bare-Surface	182.10	7.82	313.30	13.44	-131.20	-5.62	INCREASE
Farmland	1.42	0.60	518.70	22.26	-517.28	-21.66	INCREASE
Total Area (km2)	**2329.80**	**100**	**2329.80**	**100**			

Source: Computed from the images using 'field calculator' algorithm in ArcMap

The Chosen Date (1985 to 2015)

The reason for chosen the topographic map and Landsat remote sensing images taken from (1985 to 2015), is to explore the pathways for green upgrading development in ecologically fragile areas and evaluated the landscape features of the Northern desert, the changes in the area of protective forests and grazing reserves in Mubi-North, Mubi-South and Maiha Local Government Areas located in the northern part of Adamawa an agropastoral transition zone. Based on the driving factors is direct reflections of regional natural and anthropogenic impacts.

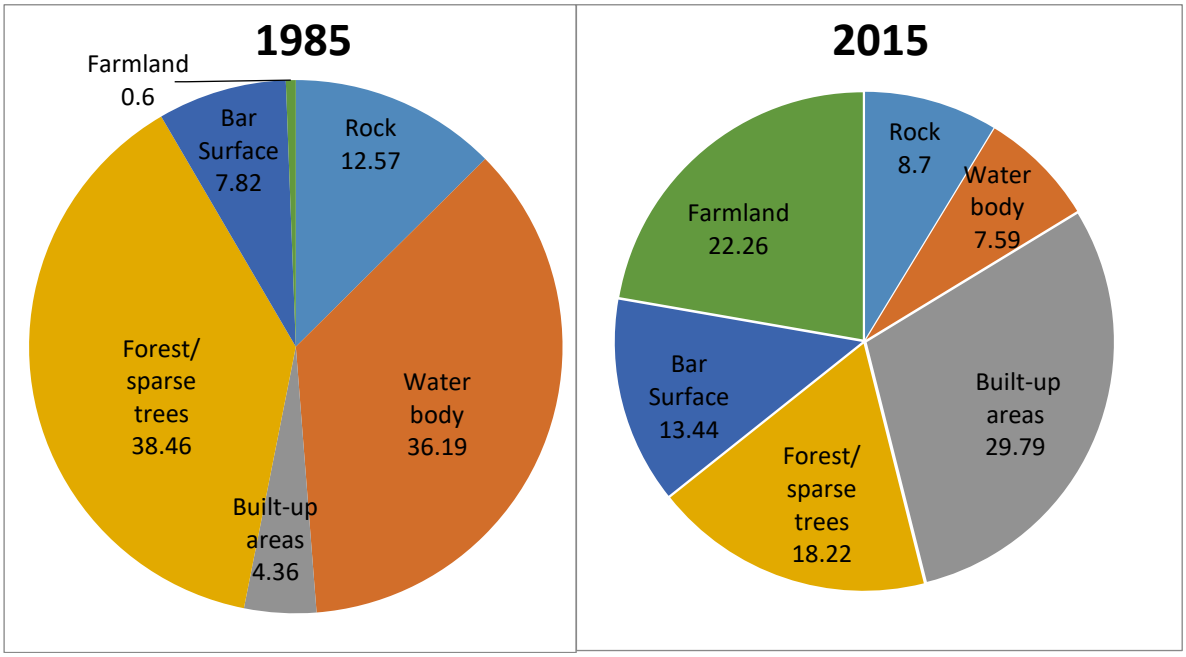


Figure 2: Pie-chart of Changes in Land Use / Cover Between 1985 - 2015

Conclusion

The study concludes that, integrated approach of Remote Sensing (RS) and Geographic Information System (GIS) was adopted in evaluating the anthropogenic activities of human as forest disturbance, forest land encroachment and felling of trees and it impact on the environment of Maiha, Mubi North and Mubi South Local Government Areas. Result revealed a notable increase in farmland and built up land in land use and land cover between1985-2015. The built-up area has change from the rate given an impression of increase over the years. The built-up expansion result to loss in natural forest/sparse trees the losses of natural vegetation also result to increase in bare- surface and farmlands whereas increased in built-up leads to increase in their sizes. Hence the study's area landscape was observed to be changing rapidly.

Recommendations and Further Study

Based on the findings of this research the following recommendations are hereby presented:

1. The State Ministry of Agriculture and Natural Resources, Forestry Department, Local Government Councils Chairmen and Ministry of Urban Planning strongly promotes ecological breeding models in the future, advocates diverse agricultural planting systems, and integrates agriculture, animal husbandry, and aquaculture.
2. To strengthens the development of green agriculture and other low-carbon environmental industries; intensively develops clean energy; reduces the impact of agricultural activities on other ecosystems.
3. Recommendations were made for forestry and woodlots long term development plan should be taken to maintain and reestablish the natural balance between vegetation and urban landscape.
4. To continues afforestation efforts constructs the ecological barrier in northern region.
5. To combats land desertification; optimizes land use structure; scientifically resolves the conflict between construction land and cropland.
6. Formulation of an integrated policy including effective and harmonized legislative framework for conservation, sustainable use and equitable sharing benefits of biodiversity and forestry.
7. Establishes an urban ecological network system to ensure the connectivity and integrity of the ecosystem is protected; enhancing information, education and communication system for forest conservation.
8. Improving information on the taxation, values and local conservation and management strategies for forest through research work.

9. Established more forest plants, woodlots, plantations and shelter belt; encourage the management practice of grazing on the range land. adaptation of ecologically friendly farming practice.
10. To Introduce effective legislation against indiscriminate tree felling and bush burning that must be enforced gradually implements ecological restoration projects and comprehensive land reclamation projects to restore soil fertility.
11. To achieve sustainable agricultural production, which is also an effective way to reduce the conflict between agriculture and ecological functions; promotes local farming; and develops characteristic animal husbandry, fruit and forestry products.
12. To encourage forest regeneration on a special legislation on both state and local government level that will guarantee the protection of forest resources fosters ecotourism and agricultural tourism through green approaches, enhancing the region's sustainable economic development.

Action Require by Individual/community/stakeholders level

i. Individuals, interest group and local government should plan and manage trees in farms in such a way as to promote forest resources by planting trees, perennial flowers and shrubs in our environment, this will prevent erosion and act as carbon storage.
ii. Support a nature- protection association by becoming a member, by making a donation, by bringing them publication and product and by participating as a volunteer in conservation and protection projects.
iii. Discuss the idea of "payment for environmental services "with friends and neighbor using the roles of trees in our environment for example they absorb run-off water, capture and convert Co_2 into O_2 shelter and food for numerous flora and fauna species.
iv. Participate in tree planting campaign and replace every tree you cut down.
v. Individuals and organizations should reduce their consumption of papers and cardboard in order to save our forest, this can be done through recycling and storing of information in hand and software of the computers.
vi. Encourage your organization to take action for forest by supporting nature-protection associations to compensate for its impact in Co_2 emissions and habitat loss.
vii. Individuals and civil societies should rise up and hold government accountable to their commitment on environmental protection
viii. Individual should make themselves available for community groups, civil organizations, to produce greater effects on forestry conservation and protection in their village and community
ix. Communities should revive their traditional knowledge, local innovations and practices for protection of forest resources.

Further Study

Future research work should address the question on how social conditions together with land uses will apply and analyze the current state of the environment as from (2015 -2025).This will require more advanced Geographical Information System (GIS) tools and geostatistical integration of Cellular Automaton (CA) and Markov Chain (MC) Models with current Sintenil-2 images for environmental modelling methods and its application in the built environment.

Acknowledgment

The research acknowledged Lecturers and Students of Urban and Regional Planning Department Modibbo Adama University, Yola-Nigeria that assist during field work. Maidjad editors and Prof. A.A. Zemba you people went on extra mile beyond the professional expectation to see that what gets to the reader is not just an error free but phrased in the right ways that will make the necessary impact.

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REPUDIATION OF RESETTLEMENTS HOUSING SCHEME FOR BURA PEOPLE IN MIRINGA TOWN, BIU BORNO STATE, NIGERIA

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Abstracts
The Bura ethnic group of Northeastern Nigeria are found in Southwestern Borno State. Bura people hold to their cosmology, and it has an impact on their dwelling. Their compounds consist of several huts. The destruction of houses and life caused by the Boko Haram insurgency necessitates the need for the construction of mass housing at Miringa village by the government of Borno State. The traditional architecture and settlement patterns of the Bura people are not merely functional; they are a manifestation of their cultural heritage and mythological beliefs. By analyzing these elements, we understand how Bura people perceive their world and express their identity through the built environment. Understanding this synergy between culture, mythology, and architecture is essential for preserving the Bura people's rich heritage. The study explores and describes the lived experience of the ethnic people. The study is termed a qualitative hegemony, and the primary means of collecting data for an existential phenomenology study lies in the process of conducting in-depth interviews with participants. The study investigated the environmental relationships between Bura villages and their wards. The distribution of settlements in Bura villages can form specific patterns according to the characteristics of the region. The result of the study shows that the houses provided are not in conformity to the way of life of the affected Bura people. For example, space within the compound can be utilized for different purposes, such as ritual, vegetable garden, playground, and relaxation.

Keywords: Bura, Repudiation, Resettlement, Housing, Borno state-Nigeria, Way of Life.

Introduction

Bura people are inhabitants of Northeastern Nigeria, particularly southwestern Borno State. According to oral tradition, they have lived in that location for about 5 centuries (Dauda, 2013). Meek (1931) asserted that the Bura lived a sedentary life, which is equally confirmed by (Davies, 1956). Bura people hold to their cosmology, and their belief patterns have had a strong impact on their dwelling. Bura are predominantly agrarian; their choice of sites for farmlands and occupational practices plays a major role in their settlement patterns. Their settlement is scattered all over the rugged landscape of the area (Basir, 2006). The people live in sparsely and thinly scattered settlements based on kinship. This consists of clusters of compounds, each consisting of several huts (Hyeladzira et al, 2023). The destruction of houses and life caused by the boko haram insurgency necessitates the construction of mass housing at Miringa village by the government of Borno State. Unfortunately, these houses were largely rejected as a result of not conforming to the lifestyle and socio-cultural livelihood of the Bura people (Atamewan, 2020).

Statement of the Problem

Housing is a fundamental human right according to the United Nations Centre for Human Settlements 2006 (Chegwe, 2014). Providing adequate housing is capital-intensive, and in most cases goes beyond the capacity of most of the populace, especially low-income earners (Oladejo and Adediran 2023; Mohammed *et al,* 2022). As such, it requires government intervention (Mohammed *et al,* 2022). Most government intervention in housing provision is often targeted at urban dwellers, and there is little consideration for rural dwellers (Ezra *et al,* 2011). Nonetheless, where there is intervention in rural areas, there seems to be little or no recognition of end-users' cultural interpretation.

Umar et al (2010) reported in a study that any failure to integrate end-user perspectives in a design will result in the rejection of the dwelling space. In concurrence with the report, the so-to-be residents rejected several Government housing intervention projects in Miringa village in the Biu Local Government area of Borno State (Abubakar, 2021). Understanding the extent to which culture shapes the dwelling and settlement pattern of the Bura people is the focus of this study.

The aim of the study

The aim of the study is to assess the resettlement housing scheme for the Bura people at Miringa village.

Objectives of the study

To examine the socio-cultural characteristics of the traditional Bura people.
To examine the physical characteristics of the traditional Bura houses.
To analyse the traditional house form of the Bura man.
To study the place of myth in their pattern of traditional house;

Theoretical Framework of the Research

The inevitable synergy of both cultural heritages of the *Bura* traditional architecture and their intangible cultural myths necessitates an understanding of the extent to which these symbols shape their dwellings and settlement patterns. Intangible values in theoretical approaches are fundamentally defined in two different ways: as a shaping factor in settlements and dwellings. Intangible cultural values and culture are closely related and, therefore, it is conceptually developed as theoretical, especially during the decline of modernism, as noted by (Jenks and George, 1969). This approach emphasizes how architecture is not merely about form and function but also the deeper meanings and cultural narratives embedded within built environments.

Raeff *et al* (2020) define scientific analysis of culture as the relationship between human needs and culture. In line with this, several authors (Ogura, 2002) attempted to establish the direct link between traditional shapes and the prevailing culture. The study intends to adopt the theory of Bourdieu 1990; and Oliver 1975, framework for the relationships between culture and intangible

cultural values that can correspond to the formulation of the relationships between practices, representations, and habitus proposed by Bourdieu. Adopting the elements of linguistics theories of signs and symbols upholds a theoretical approach to formulating the relationships between culture and built environment as a system of signs (Michael, 2018). Evaluating Oliver and Bourdieu, approach from the scope of this study, it can be stated that myths in settlements and architecture encode the cultural expressions and meanings of the Bura people.

Methodology

The purpose of this study was to explore and describe the place of myth and their link to the traditional architecture and settlements of Bura people. The study can be termed a qualitative study due to the fact that qualitative method is employed to analyses the study. The use of existential phenomenology to study the Bura people world of living and their architecture is of paramount relevance as a guide to the research methodology.

Research Design

Existential phenomenology as a methodology in research involves the study of a subject and its immediate environment (Fernandez, 2024). This directly relates to a scientific or logical approach to investigating facts, figures, and data.

The term existential phenomenology approach explicitly concerned with human existence or the human condition. This approach typically conducts in-depth interviews, analyse personal accounts, and engages in reflective practices to capture the richness and complexity of *Bura people* experiences. Phenomenological research design is particularly valuable when studying subjective experiences, emotions, and meanings that Bura people attach to various life events or situations. By employing this approach, researchers gain insights into the shared aspects of human experiences and lived experiences while also acknowledging individual variations from a qualitative perspective through this process.

Study Populations

A purposive sampling technique was used in examining some of the Bura people settlements and their dwellings that are affected, making a total of 102 populations. A convenient sampling procedure is used in sampling the 20 villages that are affected. 5 respondents for each village, making a total of 100 participants, were administered.

Sampling Procedure

Several basic guidelines are followed when selecting the participants for an existential phenomenology study. First, a participant who has experienced in the phenomenon of interest and is willing to talk about their, myth, belief, and traditional houses (Seamon and Gill, 2016). In addition, the participants are willing to participate in lengthy interviews and must give the investigator permission to publish the data in a journal.

Method of Data Collection

The primary means of collecting data for an existential phenomenology study lies in the process of conducting in-depth interviews with participants (Creswell 2007; Thomas and Pollio, 2002). The participant villages are Gur, Kimba, Mandragraw, Kaana, Mandafuma, Miya etc.

Results And Discussion

Built Environment Relationships

The study investigated the environmental relationships between the Bura villages and their wards. The results of the investigation are presented in Table 1.0 as follows:

Table 1.0 Built Environment Relationships: Comparative Studies of the Village Wards.

Response	Frequency	Percentage
Distinct values	5	11.1

Beliefs	10	22.2
Rules	15	33.3
Customs	6	13.3
People and surrounding environments	4	8.9
Congruency	5	11.1
Total	45	100

Source: Author's Analysis 2025

Figure 1.0 shows a chart obtained from table 1.0 Ethnography of Human-Built Environment Relationships Out of the 45 total respondents, there were 5 (11.1%) who believed the (distinct value) plays a vital role and 90% of the houses built in *Gur, Buratai, Kimba, Mandaragraw, Kaana, Mandafuma, Miya* wards among others have distinctive values attached to them. This shows that distinct value has an impact on all the compound houses in the study community.

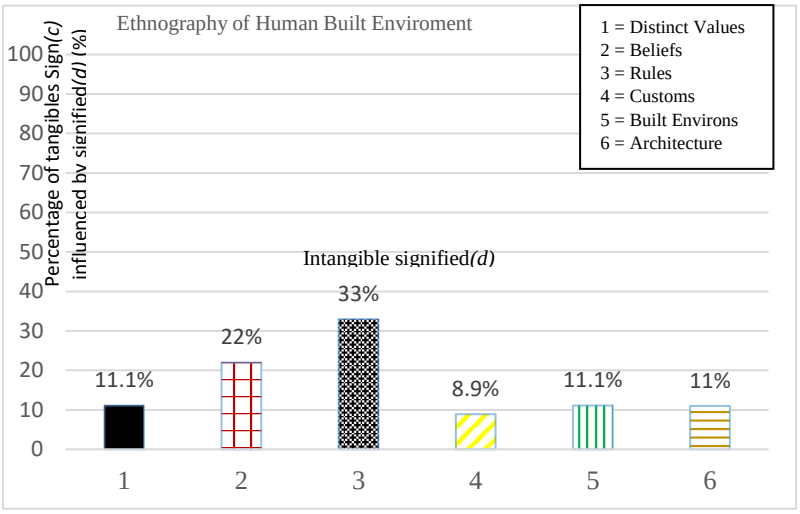

Figure 1.0 Built Environment Relationships wards sign(c)
Source: Author's Analysis 2025

From the total respondents of 45, 10 (22.2%) of the respondents are of the opinion that the beliefs they have in their ancestors have a great impact on their houses and 15 (33.3%) believe that guidelines and rules set within the community have control over the diameter of a compound and the size of houses. A total of 4 (8.9%) respondents are of the opinion that people and their surrounding environments belong to their ancestors. On the other hand, 5 (11.1%) respondents are of the opinion that rectangular forms or shapes should be for men (category B) whilst circular forms or shapes should be for women (category A). About 10 compounds have 11 men (13.4% - category B) living and sleeping in a circular hut meant for women (category A). With the information acquired from this descriptive analysis, it was gathered that the majority of the respondents are of the opinion that some rules set within the community most especially those rules guiding the diameter of the compound and sizes should be made flexible and less stringent.

1.5.2 Settlements Distribution Pattern

The distribution of settlements in Bura villages can form specific patterns according to the characteristics of the region. Settlement patterns have qualitative characteristics, supporting comparisons of distribution patterns over time and space Table 1.1 Settlements Distribution Pattern below.

Table 1.1 Settlements Distribution Pattern

Opinion	Frequency	Percentage
True	4	4.3
Not true	22	3.7
Don't know	67	72
Total	93	100

Source: Author's Analysis 2025

Figure 1.1 shows the opinions of the community on their settlements. This data is inferred from Table 1.1

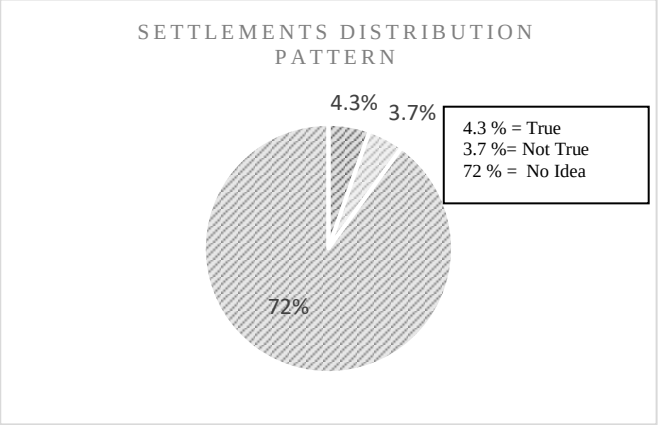

Figure 1.1 Settlements Distribution Pattern
source: Author fieldwork 2025

A total of 93 respondents, with 4 (4.3%) agreeing that settlement distribution patterns based on topography can be observed through variations in elevation and slope, resulting in clustered settlement patterns in low-lying areas to hilly terrain 10 compounds. A few of the respondents, 22 (3.7%), strongly agree that the patterns of settlements are based on slope, also reveal both clustered and dispersed settlement patterns, while a large population of the respondents, 67(72%), did not agree on any.

Physical Growth Pattern of Settlements

Factors influencing the patterns of settlements in Bura land are diverse, and they include transportation and socio-economic activities, distribution of infrastructural facilities and social amenities, economic development, social networks, and economic factors. Table 1.2.

Table 1.2 Respondents Responses on Physical Growth Pattern of Settlements

Opinion	Frequency	Percentage
True	30	50
Not true	10	16.7
Don't know	20	33.3
Total	60	100

Source: Author's Analysis 2025

Figure 1.2 shows respondent's responses to measures of the Physical Growth Pattern of Settlements.

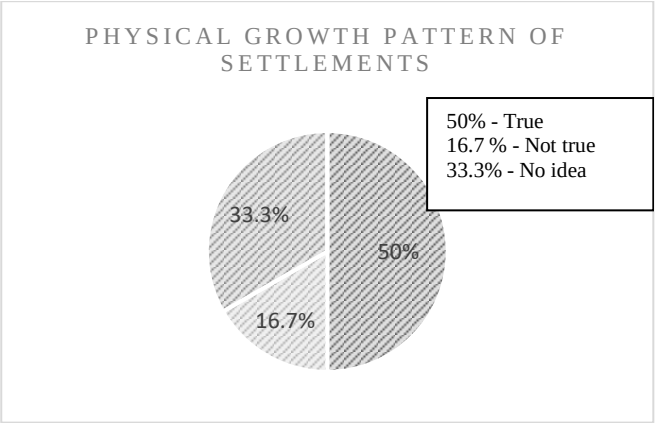

Figure 1.2 Physical Growth Pattern of Settlements
source: Author fieldwork 2025

Of 60 respondents, 30 (50%) stated that settlement growth in the traditional Bura region is not well accounted for by the existing concepts of settlement growth. A group comprising 10 respondents (16.7%) were of the opinion that Settlements are known to change spatially with time, but the patterns of such changes vary and factors that encourage spatial change are diverse, while 20 (33.3%) respondents have no answer to the question. Therefore, Studies have shown that traditional settlements in Bura land exhibit growth patterns that reflect the culture of the people.

Respondent response on settlement patterns and architecture variations

The respondent responses on settlement patterns and traditional architecture of the Bura people were investigated and reported:

Table 1.3 Respondents responses on the settlement pattern and architecture variations.

Opinion	Frequency	Percentage
True	3	6
Not true	9	17
Don't know	40	77
Total	52	100

Source: Author's Analysis 2025

Figure 1.3 shows a chart obtained from Table 1.3.

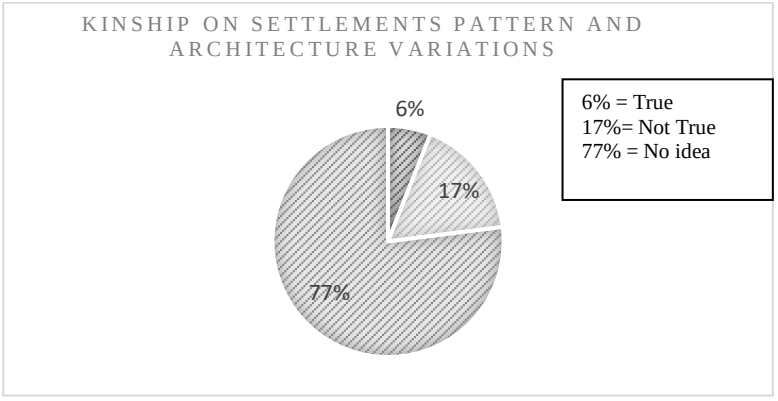

Figure 1.3 Respondents on the settlement patterns and Architecture
source: Author fieldwork 2025

52% of the respondents agree that the pattern of needs affects the culture, 17% strongly disagree, while 77% of the respondents are undecided.

Traditional Architecture Elements

Traditional architectural elements in Bura villages are characterized by a long history, cohesiveness, and subtlety. They are based on culturally sensitive techniques, empirical knowledge, and locally available materials.

Table 1.4 Traditional Architecture Elements

Opinion	Frequency	Percentage
True	4	4.3
Not true	22	3.7
Don't know	67	72
Total	93	100

Source: Author's Analysis 2025

Figure 1.4 shows the opinions of the community on Traditional architectural elements

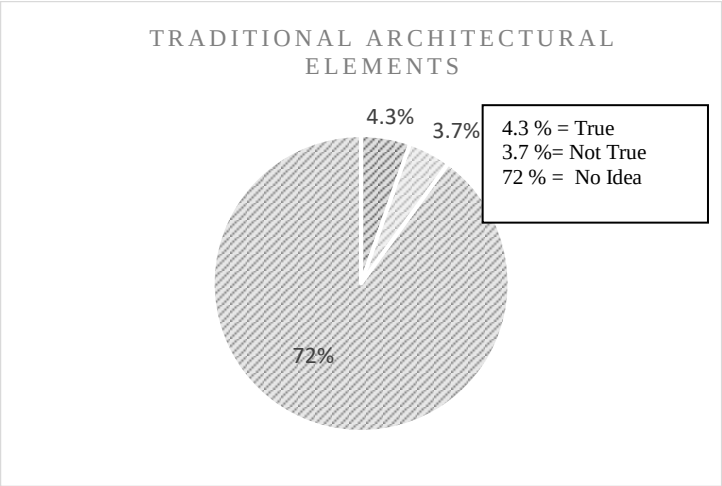

Figure 1.4 Traditional architecture elements
source: Author fieldwork 2025

A total of 93 respondents with 4 (4.3%) agreeing that they are based on culturally sensitive techniques, empirical knowledge, and locally available materials. A few respondents, 22 (3.7%), strongly agree that the use of local materials is best for traditional buildings, which look and perform their best when built from traditional, locally available materials. A large proportion of the respondents, 67 (72%), fall into one of these two categories.

Respondent responses on the use of space

Table 1.5 on the chart illustrates the opinions of the respondent regarding the establishment of a compound and how space is utilized. This domain measures community effort: It enables people to work together to influence, change, and exert control over the issues that affect their lives.
It is about a collective focus rather than a response to an individual crisis.
It challenges inequitable power relationships within society and promotes the redistribution of wealth and resources in a more just and equitable fashion.
It is based on participative processes and structures, which include and empower marginalized and excluded groups within society.
It is based on solidarity with the interests of those experiencing social exclusion.
It presents alternative ways of working and seeks to be flexible, dynamic, innovative, and creative in approach.
It challenges the nature of the relationship between the users and providers of services.
It is a wholly positive endeavor that challenges the prejudice and discrimination faced by its community without being discriminatory to any other community.

Table 1.5 Respondents responses on the use of space

Opinion	Frequency	Percentage
Community development on track	35	56.5
Community developmentally at risk	17	27.4
Community developmentally vulnerable	10	16.1
Total	62	100

Source: Author's Analysis 2025

Figure 1.5 shows the chart obtained in Table 1.5.

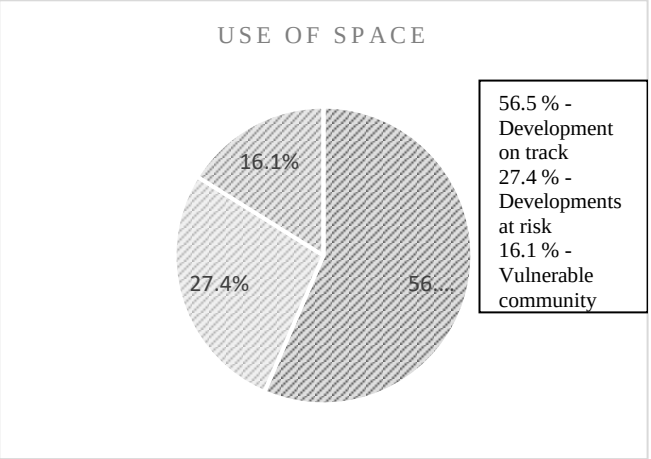

Figure 1.5 Use of Space
source: Author fieldwork 2025

From a total of 62 respondents, 35 (56.5%) indicated that the development of a compound is based on communal effort. 17 (27.4%) acknowledged that the lack of communal effort in a community is at risk. Another 10 (16.1%) of the respondents are of the opinion that if all effort is lost, the community is vulnerable.

Conclusion

The effort to understand the traditional architecture, dimension, orientation, of the Bura people is brought about by the identification of their myth and way of life. Therefore, the study focuses on both the tangible and intangible factors of the Bura people. The tangible factors are their vernacular architecture and elements associated with. Their intangible factors are their symbols and the influence on their traditional myths and belief systems. The intangible and the tangible plays a vital role in the Bura people Dwellings and any attempt to temprerd with their ancestral believe may lead to total rejection by the community. The houses provided are dissimilar to the way of life of the affected people thus lead to toatl rejection of the people. For example, space within the compound can be utilized for different purposes, such as ritual, vegetable garden, playground, and relaxation, which is the focal point in a Bura man's house has completely elimated. this action make the community to repudate resettlements housing scheme.

Contribution to knowledge

1. Stakeholders involved in the building industry should consider the end-users first, before embarking on a project in rural areas.
2. Users' participation should be encouraged in the housing scheme.

Acknowledgment

The authors wishes to thank the respondents, for the valuable information and contribution made during the research study. Their responses contributed immensely to the success of this research. The contributions of the author's research assistants, some of whom are diploma holders in Architecture. They helped in the administration of the questionnaires. Your contributions are highly appreciated.

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STRATEGIC FRAMEWORK FOR SUSTAINABLE SAFETY AND HEALTH PRACTICES IN THE NIGERIAN OIL AND GAS INDUSTRY-A SYSTEMATIC REVIEW

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Abstract
The Nigerian oil and gas industry plays a significant role in the nation's economy but faces significant challenges in ensuring sustainable safety and health practices. Persistent issues such as accidents, regulatory inefficiencies, weak enforcement, and environmental degradation highlight gaps in the current safety framework. The study utilized secondary sources, including scientific research articles, journals, conference reports, and theses. Websites such as Google Scholar, Emerald, Sage, Science Direct, and Scopus search were used to gather comprehensive literature on safety and health practices, regulatory frameworks, and sustainability in Nigeria's oil and gas sector, identifying critical factors influencing implementation. Drawing on global benchmarks from countries like Norway and the U.S., the study explores strategies such as regulatory compliance, risk management systems, technological integration, and community engagement to address these challenges. A mixed-method approach is recommended to align global best practices with Nigeria's unique socio-political and economic context. The findings emphasize the importance of fostering a strong safety culture, enhancing regulatory oversight, and incorporating advanced technologies to mitigate risks. This review contributes to the discourse on sustainable occupational health and safety, offering actionable insights for policymakers, industry stakeholders, and researchers to improve safety outcomes and environmental stewardship in Nigeria's oil and gas sector.

Keywords: Strategic Framework, Sustainability, Safety & Health, Oil and Gas Industry

Introduction

The Nigerian oil and gas industry's operational complexity, coupled with its hazardous working conditions, necessitates a comprehensive approach to safety management. While regulations such as the Nigerian Oil and Gas Industry Content Development Act (NOGICD Act 2010) have been enacted to increase local content and by extension, safety standards, there is still a gap in the practical implementation of these regulations (Muhongo, 2020). Moreover, multinational companies operating in Nigeria often apply safety standards that are tailored to their home countries, leading to a mismatch with the local context, which can further exacerbate safety and health risks (Ekhator and Iyiola-Omisore, 2021). Therefore, developing a sustainable framework that integrates local conditions, global best practices, and regulatory compliance is essential to enhancing the overall safety and health conditions within the industry. The oil and gas industry is globally recognised as one of the most hazardous sectors, with a high prevalence of occupational accidents, injuries, and fatalities. Workers in this sector are exposed to a range of risks, including exposure to toxic chemicals, high-pressure equipment, flammable materials, and extreme weather conditions. In Nigeria, these risks are compounded by additional factors such as inadequate infrastructure, lack of safety training, and poor enforcement of safety regulations. Despite the strategic importance of the oil and gas sector to Nigeria's economy, there is a noticeable gap in the adoption of effective safety and health practices that align with international standards (Nwankwo *et al.,* 2020). Addressing this gap is crucial, not only to safeguard workers but also to ensure the long-term sustainability of the industry itself. According to Ogundipe *et al.* (2020), strategies for improvement include enhanced regulatory oversight, investment in safety technology, robust safety management systems, employee empowerment and training and effective contractor management. These measures can deter unsafe practices, reduce risks, foster a strong safety culture, and mitigate risks associated with outsourced work. Hence, this study aims to create a framework for sustainable safety and health practices in the Nigerian oil and gas industry, addressing the need for robust safety measures. The framework will include risk management, regulatory compliance, training and technology integration. A systemic approach is crucial for long-term safety goals, as it ensures effective and adaptable safety practices. Therefore, this study proposes a comprehensive framework for sustainable safety and health practices in the Nigerian oil and gas industry, aiming to reduce workplace accidents and foster a safer industry.

Literature Review

Concept of Health and Safety

Health and Safety encompasses the regulations and procedures to prevent accidents or injuries in workplaces and public environments. This broad spectrum of practices and laws is designed to ensure the safety, health, and welfare of individuals at work and those affected by workplace activities. Vassiley *et al.* (2025) assert that, a prominent example is the Health and Safety at Work Act 1974 in the UK, which outlines the responsibilities of employers and employees in maintaining safe working condition. This legal framework establishes a foundation for health and safety practices protecting workers from hazards. The International Labour Organization (ILO) defines occupational health as a discipline focused on promoting and maintaining workers' highest degree of physical, mental, and social well-being. This involves preventing health issues caused by working conditions, protecting workers from risks that could adversely affect their health, and adapting work environments to fit workers' physiological and psychological capabilities (Petitta and Ghezzi., 2025).

Sustainable safety and health practices

Sustainable safety and health practices include integrating environmental sustainability principles into health and safety management systems. These practices aim to protect the health and safety of employees while minimizing environmental impact, ensuring that operations can be maintained without compromising the well-being of future generations. The World Health Organization (WHO) defines sustainability in this context as a strategy to "meet the needs of the present world population without causing adverse effects on health and on the environment, and without depleting or endangering the global resource base" (Kovacs et al., 2020). This holistic approach emphasizes that occupational health and safety (OHS) must align with sustainable development goals, balancing

worker protection and environmental stewardship. Implementing Health, Safety, and Environment (HSE) management systems is a core element of sustainable safety and health practices. HSE encompasses a range of policies and practices designed to minimize hazards, prevent accidents and injuries, and promote sustainable practices within organizations (Acheampong and Kemp, 2022). By embedding sustainability into HSE frameworks, organizations can foster a safety culture that protects workers and addresses environmental concerns. This involves continuously assessing risks, implementing controls, and improving performance to prevent harm to people and the environment.

Current Level of Safety and Health Practices in the Nigerian Oil and Gas Industry

In relation to persistent safety concerns in the Nigerian oil and gas industry, regulatory agencies such as, the Nigerian Upstream Petroleum Regulatory Commission (NUPRC) have implemented stringent guidelines to enhance operational safety and risk management. One of such regulation is the Safety Case Guideline 2020, which establishes a structured approach for identifying, assessing, and mitigating hazards in upstream petroleum operations (Zannah and Misnan, 2025). The Safety Case Guideline 2020 mandates that operators develop comprehensive safety cases demonstrating the occurrences of identified potential risks so as implement adequate control measures and put in place emergency response plans to protect workers, the environment, and assets. This guideline aligns with global best practices in risk management and is designed to foster a proactive safety culture within the industry. Operators are required by this recommendation to create thorough safety management systems that reduce operational hazards (Schuett, 2023). Operators must do Formal Safety Assessments (FSA) as required by the Safety Case, which describes possible risks and the steps taken to reduce them. Given the unstable nature of oil extraction operations in areas like the Niger Delta, this proactive strategy seeks to guarantee that all facilities maintain a high quality of safety compliance (Sam *et al.,* 2024). Studies show that, despite these rules, different industrial sectors follow safety procedures inconsistently. According to a poll, management commitment and organizational safety rules are prioritises, while staff incentives and training are not as well-funded. To increase overall compliance and lower accident rates, it is stressed that regular safety evaluations and ongoing employee involvement in safety culture are essential (Zhang and Wang, 2023).

Challenges in Safety and Health Practices Implementation

The sufficiency of regulatory enforcement is one of the main issues confronting Nigeria's oil and gas sector. Operator compliance is an issue despite the Department of Petroleum Resources' (DPR) commitment to upholding HSE regulations (John *et al.,* 2022). This problem is made worse by the lax sanctions for non-compliance, which let risky behaviours continue without sufficient consequences. Furthermore, many operators regularly lack the knowledge and equipment to apply efficient safety measures (Schuett, 2023). Furthermore, there is a notable deficiency in staff training programs concerning HSE norms. Many employees continue to work without enough awareness of possible risks or emergency response methods, even in companies that have implemented strong training programs (Olaniran and Akinbile, 2023). This shortcoming raises the possibility of workplace accidents and thwarts initiatives to promote a safe workplace culture. An essential part of efficient safety management systems is training. According to research, employees' adherence to safety procedures in the oil and gas industry strongly correlates with their educational backgrounds (Quaigrain *et al.,* 2024). As a result, businesses need to spend money on thorough training programs designed to handle certain risks that employees may encounter. In addition to teaching technical skills, these programs should encourage personnel to report safety incidents proactively (Acheampong and Kemp, 2022). Employee adherence to safety procedures can also be increased by implementing incentive programs for safe conduct. Organizations' safety culture may be improved by praising and rewarding compliance (Hardley, 2025).

Dzedzemoon & Ferro (2024) revealed that, the Nigeria's oil and gas industry's present state of safety and health procedures indicates both advancements and enduring difficulties. Although safety standards can be improved using legislative frameworks such as the Safety Case Guideline 2020, effective execution is still uneven. The industry may transition to more environmentally friendly and

worker-safe health and safety procedures by implementing a systematic framework that prioritizes training, frequent audits, stakeholder cooperation, incentives, technology integration, and strong leadership commitment.

Factors Influencing Sustainable Safety and Health Practices in the Nigerian Oil and Gas Industry

The Nigerian oil and gas industry, a significant contributor to the national economy, faces numerous challenges in implementing Sustainable Safety and Health (SSH) practices. Several factors influence the successful implementation of these practices. A remarkable gap in the current research is the limited empirical research assessing the effectiveness of risk-based safety strategies in the Nigerian oil and gas sector, specifically within the context of the Niger Delta region. While several studies have identified the significant occupational health risks, regulatory challenges, and safety issues in the industry, there is a lack of in-depth evaluation of the actual risk management frameworks implemented by companies in the region. Although some research touches on safety climate perceptions, compliance, and environmental hazards, studies focusing on how specific risk-based strategies are adopted and their direct impact on reducing accidents and fatalities are scarce. In addition, the influence of local factors, such as, infrastructure deficiencies, security concerns, and cultural attitudes towards safety, on the implementation and success of these strategies remains underexplored. Given the unique operational environment in the Niger Delta, further research is needed to analyze the specific strategies used by both multinational and indigenous firms, and how these strategies compare to international best practices in terms of effectiveness, sustainability, and adaptability in mitigating the risks inherent to the sector. limited of risk-based safety strategies in the Nigerian oil and gas sector, specifically within the context of the Niger Delta region as illustrated in figure 1.0.

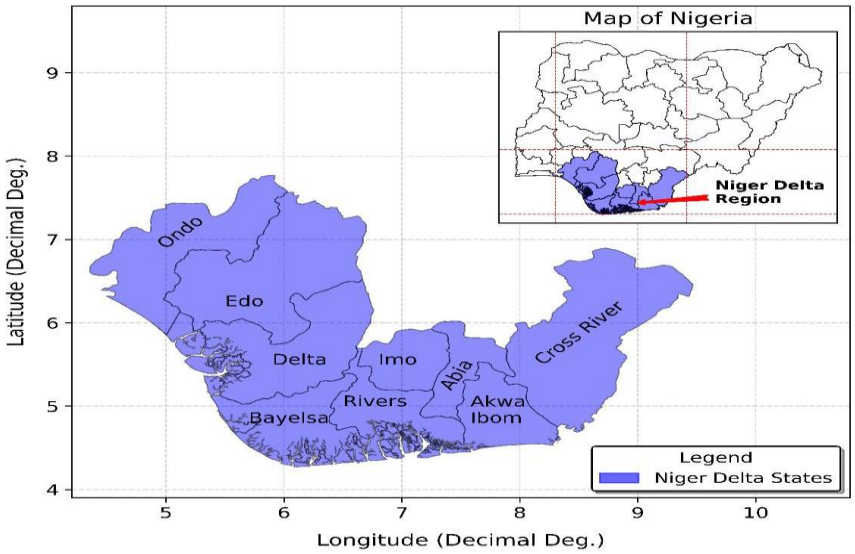

Figure 1: Study Area (Jatto, 2024)

Regulatory Influence and Policy Gap.

Nigeria's regulatory framework on occupational health and safety (OHS) has evolved, starting from early acts such as the Factories Act (1987) to the Labour, Safety, Health, and Welfare (Omotehinse, 2022). Despite these regulations, there are gaps in enforcement due to limited government oversight, inadequate funding, and inconsistent policy updates, which weaken compliance in the oil and gas sector. Companies often prioritize profitability over safety compliance, requiring more rigorous policy enforcement to foster sustainable practices(Jain et al., 2024). A critical component is the role of regulatory enforcement, which remains essential for minimizing hazards and safeguarding employee welfare. Studies highlight that strict adherence to industry standards and robust governmental oversights are foundational in curbing accident rates and ensuring health and safety compliance (Lin *et al.,* 2021).

Management Commitment and Organizational Culture

Kar and Jha (2021) revealed that, Management's commitment to safety is one of the top factors impacting sustainable safety and health practices. Companies where leadership prioritises safety and health often report better safety outcomes and higher employee compliance. However, some organizations struggle to maintain this commitment, especially under financial or production pressures. Effective implementation often requires integrating safety and health as a core part of organizational culture, emphasizing regular safety inspections, training, and transparent safety communication, which research shows is essential for reducing accidents and improving workplace safety. Organizational culture, specifically the commitment from leadership towards safety, is another key influencer. Leadership's dedication to maintaining high safety standards, fostering open communication, and engaging employees in safety protocols contributes to a positive safety culture that is shown to reduce incidents and near-misses. Employee involvement, driven by training programs tailored to address industry-specific risks, further strengthens organizational safety and health standards (Ekong *et al.,* 2021). Training remains particularly important in equipping workers with the necessary skills to handle emergencies and follow safety protocols, making training a primary focus in health and safety strategies across the sector (Chan *et al.,* 2025).

Employee Training and Awareness

Sustainable safety and health practices rely on a well-informed and adequately trained workforce. Training is critical in the oil and gas sector, where the risk of incidents is high. Studies highlight that a lack of workforce training, especially among contractors or temporary workers, is a significant barrier to safety implementation. Increased focus on regular and comprehensive training programs tailored to industry-specific hazards can significantly enhance safety practices. Employees who understand safety protocols and feel empowered to enforce them are likelier to contribute to a safer work environment (Jeelani and Gheisari, 2021).

Technological Adoption

Modern safety technologies such as predictive analytics, real-time monitoring, and automated alerts can drastically improve safety in hazardous environments. However, Nigeria’s oil and gas industry faces barriers to adopting such technologies, including cost constraints, inadequate technical expertise, and limited infrastructural support. While advanced technology has been recognized as a crucial component for enhancing workplace safety, investment in these technologies remains relatively low, underscoring the need for policies encouraging or incentivizing technological advancements in safety and health practices (Nnaji and Karakhan, 2020). Technical advancements such as drone surveillance and digital monitoring systems are being explored within the Nigerian context to identify hazards proactively, allowing companies to respond to risks effectively (Akinradewo and Arijeloye, 2020). Additionally, emergency preparedness, including regular drills and resource allocation, is emphasized as crucial to ensuring swift, coordinated responses to disasters, which is vital in high-risk settings like oil and gas (Al-Husain, 2023).

Environmental and Community Health Concerns

The Nigerian oil and gas sector also faces pressure from communities affected by oil exploration activities, which can lead to environmental health issues. Oil spills and gas flaring are common in the Niger Delta, impacting community health and safety. Sustainable safety and health practices in the industry must, therefore, extend beyond internal operations to consider the broader environmental impacts and community health concerns. Implementing strict environmental regulations and improving ecological management is crucial for addressing these community safety issues, which ultimately influence the industry's safety and health policies (Jain *et al.,* 2024).

Human Resource Management

Human Resource Management (HRM) ensures safety within the oil and gas industry. HRM is responsible for developing and implementing safety policies, training programs, and safety culture initiatives to mitigate risks and ensure a safe working environment (Jeelani and Gheisari, 2021). The role of HRM in safety management is vital in promoting mindful safety practices and fostering a

safety climate within the industry. Moreover, HRM is instrumental in developing safety and health educational management information systems, decision support systems, and risk-based inspection approaches to enhance safety and risk mitigation (Oduoza *et al.,* 2023). In summary, sustainable safety and health practices in the Nigerian oil and gas industry are shaped by regulatory frameworks, management commitment, employee training, technology adoption, and community concerns. Effective implementation requires aligning organizational practices with stringent regulatory standards and integrating community-focused environmental considerations. Improved regulatory enforcement, technological investment, human resource management, and an organizational culture rooted in safety are essential for achieving sustained safety improvements in the industry.

Strategies to Improve the Implementation of Sustainable Safety and Health Practices in the Nigerian Oil and Gas Industry

Several strategic approaches are based on recent research and frameworks to enhance the implementation of sustainable safety and health practices in Nigeria's oil and gas industry. These strategies focus on organizational practices, regulatory advancements, and technological innovations to create a safer, more environmentally responsible sector. These strategies are:

Development of a Comprehensive Health, Safety, and Environment (HSE) Framework

Establishing a robust Health Safety and Environment (HSE) framework is fundamental to standardizing health and safety practices in oil and gas operations. This approach involves implementing environmental, process, personal, and transportation safety guidelines. For instance, the International Association of Oil & Gas Producers (IOGP) outlines frameworks that manage offshore and onshore safety protocols, which can serve as benchmarks for Nigeria's industry to reduce accident rates and address hazardous exposures (Orikpete and Ewim, 2023).

Enforcement of the Petroleum Industry Act (PIA), 2021

The Petroleum Industry Act (PIA) introduces new regulatory mechanisms to encourage environmental sustainability, especially targeting gas flaring and other environmentally detrimental practices. By leveraging provisions in the PIA, companies are incentivized to comply with environmental standards and adopt sustainable practices, reducing pollution and improving health outcomes for workers and communities. This legislative support underpins stronger regulatory oversight and encourages companies to implement sustainable health and safety strategies (Umeokafor *et al.,* 2022).

Community Engagement and Awareness Programmes

Jatto (2024) stated that engaging local communities in monitoring pipelines and infrastructure can help reduce incidents of vandalism and unauthorized access, often resulting in oil spills. Worden *et al.* (2024) revealed that, this strategy fosters a safer work environment and builds trust between companies and local populations whereby companies like Shell Nigeria have successfully piloted community contracts for monitoring pipelines, thus enhancing preventive efforts against environmental hazards in the Niger Delta.

Use of Technology and Surveillance Systems

Technology solutions like over flights, CCTV, anti-tamper locks, and digital wellhead monitoring systems can help prevent and promptly address pipeline tampering. These technologies have shown promise in reducing incidents of crude oil theft and vandalism in the Niger Delta, contributing significantly to both environmental protection and safety compliance (Akinradewo and Arijeloye, 2020).

Training and Capacity Building

Regular training programs ensure that employees are up to date with the latest safety practices and regulatory requirements. Training initiatives are essential for developing a safety-conscious culture within organizations, ensuring that all workers are equipped to handle emergencies and adhere to best practices in HSE management (Ikpor *et al.,* 2022).

Public-Private Partnerships and International Collaboration
Collaborating with international environmental bodies, such as the International Union for Conservation of Nature (IUCN), helps local companies enhance their remediation techniques and safeguard biodiversity around operational sites. This collaboration can extend to sharing technology, training, and resources, enabling Nigeria's oil and gas industry to align more closely with global sustainability standards (Lv *et al.,* 2023).

Comprehensive Risk Assessment and Management Systems
Goni *et al.* (2024) opined that Implementing thorough risk assessment and proactive management systems can help address potential hazards before incidents occur. Regular risk assessments allow companies to monitor and address high-risk areas, particularly in the Niger Delta, where pipeline leaks and equipment malfunctions are common. Risk management frameworks integrating predictive analytics can identify potential equipment or operations failures, enabling pre-emptive maintenance and reducing safety incidents.

Strengthening Environmental Responsibility and Compliance
Improving environmental responsibility is essential for sustainable safety practices, especially given the ecological challenges in oil-producing regions like the Niger Delta. Companies should adopt more comprehensive environmental monitoring and remediation techniques to mitigate impacts on biodiversity and local communities. For instance, ecological assessments can identify areas needing urgent intervention, while eco-friendly remediation strategies, such as bioremediation, can help address oil spills with minimal environmental disruption (Okeke *et al.,* 2022). Engaging with global environmental organizations, such as the International Union for Conservation of Nature (IUCN), support and guidance can further enhance these initiatives (Krug *et al.,* 2020).

Theoretical Review
Developing a robust framework for implementing sustainable safety and health practices in the Nigerian oil and gas industry requires a solid theoretical foundation. Here are some key theories that can provide valuable insights:

Systems Theory
Systems theory is a multidisciplinary framework examining how people interact and adjust to their surroundings to comprehend society's functions. It draws attention to how intricately relationships and dependencies influence actions and results. Concerning an individual, group, or organization, this method demonstrates how each element influences and is influenced by the system as a whole (Ali *et al.,* 2022). The science of systems theory aims to compare and contrast different systems. The word systems refer to objects (discrete systems) and purposeful constructs of the mind that are abstract in exchange between people, such as the conceptualization of an organization as a system (Wilchek *et al.,* 2025). Differentiating between systems in reality facilitates description, analysis, and creation. There are various kinds of systems, including physicochemical systems, mental systems, social systems, machinery (especially computers), and organisms (people, animals, and especially cognitive mechanisms in organisms). Physicochemical systems, social systems, psychological systems, and machines (especially computers). A highly general concept of systems is necessary for such a comparative research program for heterogeneous types of systems.

Several features have been proposed for this concept, including the interdependency of the system's parts, the reference of any structure or process to the system's environments, equilibrium, adaptability, and on-going re-adaptations to environmental demands as fundamental components of understanding a system, the system's self-organization as the primary way it responds to external intervention, complexity as a trigger mechanism for system-formation, and the form that describes the internal network structures of connectedness among system elements (Shi *et al.,* 2021). Systems theory aids in the development of structured methods to enhance and maximize these connections by analyzing the interactions, dependencies, and overall dynamics within a system. By

comprehending how various components influence each other, it enables the creation of efficient strategies to improve functionality, streamline processes, and optimize overall system performance.

Human Factors Engineering

The scientific discipline of Human Factors Engineering (HFE) seeks to establish the best possible relationship between humans and their working environments by considering their strengths, limits, and traits (Nobles *et al.,* 2025). In this context, the term "environment" refers to the surrounding air, equipment and supplies, work practices and processes, and systems associated with the individual (Wolffsohn *et al.,* 2023). The aim is to design for safe, comfortable, and efficient human usage. User-centered design, usability engineering, and ergonomics are often used interchangeably. HFE's basic tenet is that technology and procedures should be developed and applied to meet users' "real-world" demands rather than those "imagined" by individuals who are far away from them (Vogel and Musamba, 2024). Well-designed human factors in industrial processes impact two crucial production characteristics. User needs, user characteristics, and end-user testing of the human-machine interface are the main topics of this design process (Billa and Chavali, 2023). First, long-term, unintentional stressors can impair a person's capacity to function or generate needless safety risks, as well as lead to disability in later life. Second, there may be decreased output and, in the worst situation, catastrophe if the operator's capabilities do not match the work requirements (Wolffsohn *et al.,* 2023).

The idea of iterative design and testing is another essential component of this user-centered design methodology. To put it simply, the design is continuously improved throughout the design cycle based on input from user testing, also known as usability testing, which is also continuously carried out, beginning at the beginning of the design cycle. This makes it more likely that the system will fulfil its intended function and function as intended. Before the system is put into service, early testing also helps to guarantee that design flaws are found and fixed (Bharany *et al.,* 2022). Human factor Engineers have long emphasized the significance of human performance constraints as a cause of safety risk and error and the critical role of staff members' physical and mental health in human performance levels. A worker's physical or mental exhaustion and the possibility of being sidetracked by personal issues, such as illness in the family or marital strife, are included in this. By building tools and work processes according to good Human Factors Engineering principles, the goal is to decrease the likelihood of human mistakes and lessen the impact of errors that do occur. The outcome of HFE efforts should be an installation that facilitates maintenance tasks, supports emergency responses, and enhances situational awareness for personnel operating in control rooms, buildings, and other plant areas (Karwowski & Zhang, 2021).

Behavioural Safety

According to behavioural psychology, workplace injuries can be reduced by altering at-risk behaviours, which forms the basis of behavioural safety programs, which are the "application of the science of behaviour change to real-world safety problems." According to the assumption, these behaviours are crucial targets for intervention since they are visible and quantifiable preludes to accidents (Yiu, 2023). It is believed that Herbert William Heinrich, a pioneer in industrial safety, did research that led to the development of behavioural safety theory between 1886 and 1962. According to Heinrich's studies from the early 20th century, risky behaviours, not environmental conditions, are responsible for most workplace accidents (about 95%). When behaviour-based safety began to show promise in lowering workplace accidents in 1984, it was thought to be the only strategy required to increase safety and lower incidents (Fu *et al.,* 2020). A rising understanding of the significance of behavioural interventions in improving workplace safety is demonstrated by the progression of ideas from Heinrich's pioneering research to the formalization of BBS (Junwu *et al.,* 2024). Behavioural safety, or behaviour-based safety, has thrived in industrial environments worldwide, where most industries that wish to enhance their safety record have prioritises behavioural safety training and implementation (Maliha *et al.,* 2021). Construction, healthcare and hospitals, mining, office environments, transportation, and manufacturing are just a few industries that have effectively adopted behavioural safety as a workplace safety strategy (Gravina *et al.,* 2020).

Investigating behavioural antecedents and consequences is a key component of behavioural safety. The elements that precede and set off a certain behaviour are known as behavioural antecedents. Behavioural safety is crucial in safety management, especially in high-risk sectors like manufacturing, construction, and oil and gas. In its broadest sense, behavioural safety concerns comprehending and influencing people's actions to enhance safety results (Masoumi, 2023).

It acknowledges that human behaviour frequently serves as the primary cause of mishaps at work and highlights the significance of fostering an atmosphere that encourages safe behaviour while discouraging risky behaviour. Key components of behaviour-based safety (BBS) are essential for behavioural safety initiatives to be implemented successfully. The difference between proactive and reactive safety measures is one of the main differences in safety management. While reactive approaches to safety only address safety after an incident, proactive approaches concentrate on identifying and reducing risks before occurrences (Rahmiaty, 2021). By encouraging companies to recognize risky behaviors and take action before accidents occur, BBS supports proactive safety. Fostering a culture of safety vigilance and continual improvement requires this mentality change. Enhancing safety communication through BBS lowers the likelihood of workplace injuries and promotes a more positive and healthy organizational safety culture (Sadykov *et al.,* 2022).

Frameworks Strategies

In order to integrate optimal practices pertaining to sustainable safety and health, Nigeria's oil and gas sector may benefit from examining the frameworks and strategies employed by nations such as the United States, Saudi Arabia, Russia, and China. These countries have developed robust systems that Nigeria has the potential to adapt for the improvement of safety, health, and sustainability within this industry. The following sections outline recommendations derived from the principal frameworks established in each of these nations:

The United States employs key frameworks such as the Occupational Safety and Health Administration (OSHA) regulations and the Environmental Protection Agency (EPA) regulations (Odili et al., 2024) The country also has robust sustainability reporting systems like the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB), which Nigeria could adopt to monitor environmental impact, worker safety, and health concerns. The comprehensive safety standards provided by OSHA in the U.S. could be adapted for Nigeria's upstream oil and gas sector. These include protocols for personal protective equipment (PPE), emergency response, workplace ergonomics, hazard communication, and managing toxic substances. To enhance environmental safety, Nigeria could implement EPA frameworks focusing on pollution control, waste management, and emission reduction during exploration and drilling activities. The U.S. sustainability reporting frameworks, such as GRI and SASB, offer valuable tools for Nigeria to effectively track and address environmental, health, and worker safety challenges.

Saudi Aramco operates a robust Safety, Health, and Environment (SHE) management system designed to ensure comprehensive oversight and adherence to safety standards. Saudi Aramco adopts a proactive safety strategy that integrates risk assessments, routine audits, and hazard identification (Al-Otaibi and Kineber, 2023). Implementing similar systems in Nigeria could help detect risks early and minimize accidents. The company prioritizes employee well-being through fitness initiatives, mental health support, and the provision of on-site medical facilities. Nigeria could implement these measures to enhance worker health and reduce occupational illnesses. Saudi Aramco is committed to lowering its environmental impact by utilizing technologies like carbon capture and cleaner energy solutions. Nigeria could achieve similar benefits by investing in areas such as methane leak detection and control.

Russia relies on its State Standards (GOST) and Gazprom's advanced safety and environmental protocols to ensure safety in the energy sector. The GOST technical standards provide comprehensive guidelines for maintaining safety in high-risk industries like oil and gas (Razmanova *et al.,* 2023). These standards address aspects such as equipment safety and environmental safeguards during oil extraction and transportation. Gazprom, Russia's leading energy company, has

implemented detailed emergency response strategies, including measures for oil spill containment and firefighting. Nigeria could benefit from developing similar contingency plans to handle oil spills, fires, and other emergencies effectively. Gazprom emphasizes extensive worker training, focusing on the proper use of safety equipment and emergency response protocols. Nigeria could adopt comparable training programs, incorporating simulations and practical drills to enhance workforce preparedness.

China's health, safety, and environmental standards are guided by the National Health and Safety Standards and CNPC's Environmental Framework. Key principles include compliance with the China National Petroleum Corporation (CNPC) safety standards and the Chinese Environmental Protection Law (Wang *et al.,* 2022). CNPC utilizes advanced safety management systems in upstream oil and gas operations, prioritizing risk analysis and hazard prevention. Additionally, China enforces strict environmental regulations to manage waste, emissions, and water usage in oil production (Song *et al.,* 2022). Nigeria could adopt similar measures to uphold high standards of environmental protection and minimize pollution. Furthermore, China underscores the importance of continuous monitoring of environmental impacts and worker safety. Nigeria might benefit from implementing real-time monitoring systems to track air and water quality, waste management, and other environmental indicators.

Nations endowed with substantial oil resources implement a combination of governmental regulations, industry benchmarks, and corporate measures to promote sustainable safety and health practices within their upstream oil and gas sectors. Although these frameworks exhibit common foundational components such as; risk management, process safety and environmental conservation, they are distinctly influenced by the socio-political environment, regulatory framework, and industrial capabilities of each country. These will provide useful lessons for Nigeria in developing its sustainable model for harmonizing regulatory compliance with continuous improvement. Nigeria should set up a regime that adopts best practices from the OSHA model of the USA, Saudi Aramco of Saudi Arabia, GOST of Russia, and CNPC of China. This model should be robust in the management of worker health and safety, environmental sustainability, risk management, and preparedness in dealing with emergency situations. There should be robust training programs put in place in order to strengthen technical skills and safety awareness. Such programs can leverage both in-person instruction and virtual tools, including simulations and digital platforms, to improve workforce competencies. Developing initiatives focused on energy efficiency, carbon footprint reduction, waste management, and water conservation is critical. Innovative technologies like Carbon Capture and Storage (CCS) and the integration of renewable energy sources should be explored in order to further sustainable practices. International organizations, local government entities, and stakeholders from the private sector will bring about coherence with global standards. Such collaboration may spur the application of international certifications (for example, ISO, OHSAS) and foster partnerships with multinational oil corporations, hence improving industry standards. Sophisticated technologies like IoT sensors, AI, and satellite surveillance should be used to observe environmental parameters, health indicators, and safety procedures in real time. These instruments will enable adherence to health and safety regulations and will respond quickly in cases of possible hazards as illustrated in figure 2.0.

Figure 2.0 Sustainable safety and health practices frameworks used by oil rich nations (Dhali *et al.*, 2023)

This consolidation of best practices from international models, together with the recommended bespoke adaptations, presents a road map for Nigeria to achieve a safer and sustainable upstream oil and gas sector. Through the aforementioned regulatory alignment, extensive training regimen, sustainability efforts, stakeholder engagement, and cutting-edge technological supervision, Nigeria will be well-placed to deal with some serious concerns related to workforce safety, environmental preservation, and efficiency of operations. This broad-based approach would not only enhance compliance with global standards but also foster innovation and resilience in the sector. Over the long term, these programs will help ensure that the oil and gas industry in Nigeria continues to be economically and environmentally sustainable, ensuring the preservation of its competitiveness into an increasingly globalized and environmentally sensitive market.

Methodology

This review is based on a systematic analysis of existing literature on the safety and health practices models. The literature was sourced from academic journals, books, and reputable online databases. Online journals were searched from Emerald, Scopus indexed, Sage, Science Direct, Wiley Online Library, Taylor & Francis Online, ProQuest, Springer, Semantic Scholar, and Google Scholar to broaden the search. The scope of the review focuses on the current state of safety and health practices in the Nigerian oil and gas industry, regulatory frameworks, sustainability initiatives, and lessons from global best practices. This methodology ensures a systematic and comprehensive review, offering actionable insights into improving safety and sustainability in Nigeria's oil and gas industry while contributing to the global discourse on occupational safety

Findings

This review of safety and health practices in the Nigerian oil and gas industry reveals several challenges, regulatory gaps, and potential strategies for improvement. The industry faces frequent accidents and hazards due to high-risk operations, human error, and insufficient training. A weak safety culture, marked by poor management commitment and ineffective communication, limits worker empowerment and prioritizes safety in daily operations. Environmental and community impacts, such as oil spills, gas flaring, and deforestation, contribute to environmental degradation and health issues. Existing laws, such as the PIA and Associated Gas Re-Injection Act, face poor enforcement and socio-political challenges. Technological deficiencies, such as inadequate surveillance systems and outdated equipment, hamper risk management. Management commitment, lacking a focus on safety culture, results in suboptimal safety management practices, with companies often prioritizing short-term gains over long-term safety and sustainability.

Conclusion

In conclusion, this review provides actionable insights for policymakers, industry stakeholders, and researchers to drive safety improvements in Nigeria’s oil and gas industry. Future efforts should

focus on bridging the gap between regulatory policy and implementation, exploring cost-effective technologies, and monitoring long-term outcomes of proposed safety frameworks. By adopting a holistic, localized approach, the industry can ensure a safer, more sustainable future for workers, communities, and the environment. The findings underscore the urgency of addressing safety and health challenges in Nigeria's oil and gas sector. By adopting a holistic framework that integrates global best practices with localized solutions, the industry can achieve sustainable safety outcomes. Strengthening regulatory enforcement, fostering a strong safety culture, and engaging communities are pivotal to ensuring the sector's long-term resilience and sustainability.

Recommendation

The oil and gas industry in Nigeria should implement several recommendations to improve safety and health practices. These include enforcing the Petroleum Industry Act (PIA), empowering employees to report hazards, adopting advanced monitoring systems like real-time surveillance and predictive analytics, upgrading equipment and infrastructure, promoting digital safety solutions, and involving community representatives in decision-making. Ensuring consistent enforcement of the PIA will help address safety, transparency, and environmental challenges. Additionally, implementing real-time monitoring technologies like IoT-enabled sensors can help identify and mitigate risks proactively. Upgrading outdated machinery and systems with modern alternatives can minimize equipment failures.

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ANALYSING CULTURAL SYMBOL IN A PLACE OF WORSHIP: A CASE STUDY OF NIGERIAN NATIONAL MOSQUE ABUJA

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Abstract
The Nigerian National Mosque is situated in Abuja and stands for a colossal blend of Islamic architectural styles and Nigerian cultural traditions. Built in 1984, it is a center of religious and national pride, which conveys Nigeria's stand for diversity not only in religion but also in culture. This paper critically examines the mosque's installation as a public work of art which is discussed through the prism of visual culture in representation, ethics, global perspectives, subjective interpretations, and identity construction. This study maintains that based on the mosque's design and purposes, the mosque is seen not only as a house of worship but also as a major cultural and social symbol in Nigeria.

Keywords: Religious Architecture, Cultural Identity, Public Art Installation, Visual Culture, Religious Pluralism. National Mosque Abuja

Introduction

The Nigerian National Mosque is a Nigerian cultural and religious history landmark. It is located right in the centre of Abuja, the national capital. It was designed to be the country's central mosque for its large Muslim population, and it was completed in 1984. Architecturally, this mosque has been regarded as a masterpiece that represents Islamic architectural inspiration combined with Nigeria's rich cultural heritage. Through such symbolic design, ethical dimensions, global stance, diverse readings, and identity shaping, the mosque reinforces its surroundings and audiences.

The aim of this paper is to focus on how the national mosque visually engages with its environment and audience and explore the following attributes of visual culture; Representation, Ethics and Responsibilities, Global Perspectives, Subjective Interpretation and Identity Construction to evaluate the role of the mosque in representing Nigerian identity and cultural heritage and to examine the architectural design and artistic elements of the Nigerian National Mosque as a public art piece.

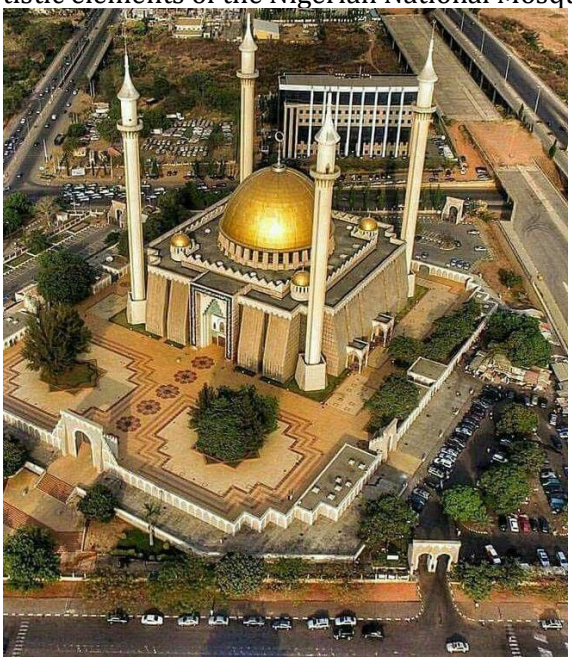

Figure 1: Aerial view of the National Mosque, Source: Sayed A. (2022)

Nigeria's religious and cultural identity is well represented by the Nigerian National Mosque which is a powerful symbol. Incorporating traditional Islamic elements and motifs from Nigerian culture, its architectural design depicts the country's vast artistic background (Adegbite, 2010). The central dome of the mosque is big and covered in gold, signifying the holy light of Islam whilst each of its four minarets at a height of 120 meters stands tall echoing the call to prayer that reverberates across the city. This blending of Nigerian and Islamic influences underscores Nigeria's cultural richness as well as religious pluralism.

Figure 2: Facade of the mosque, Source: Iqnar.com (2018)

Findings And Discussions

Representation

The unity and coexistence among various religious communities in Nigeria can be seen through this mosque. Its strategic position in Abuja, Nigeria's capital city also shows it acts as a spiritual centre for Muslims living in Nigeria. The Mosque serves as a reminder of how much tolerance exists in Nigeria towards religion and also an acknowledgment of Muslim contributions to Nigeria history (Smith, 2012). It also works as a national symbol that helps reinforce beliefs in multicultural societies which welcome diversity instead of differences.

Inside the mosques, it has intricate carved wooden panels, beautiful patterns of geometric designs, marble floors, and calligraphic inscriptions from the Holy Quran on walls that have been designed for the mosque, and mosaics reflecting the rich artistic traditions of the Islamic culture.

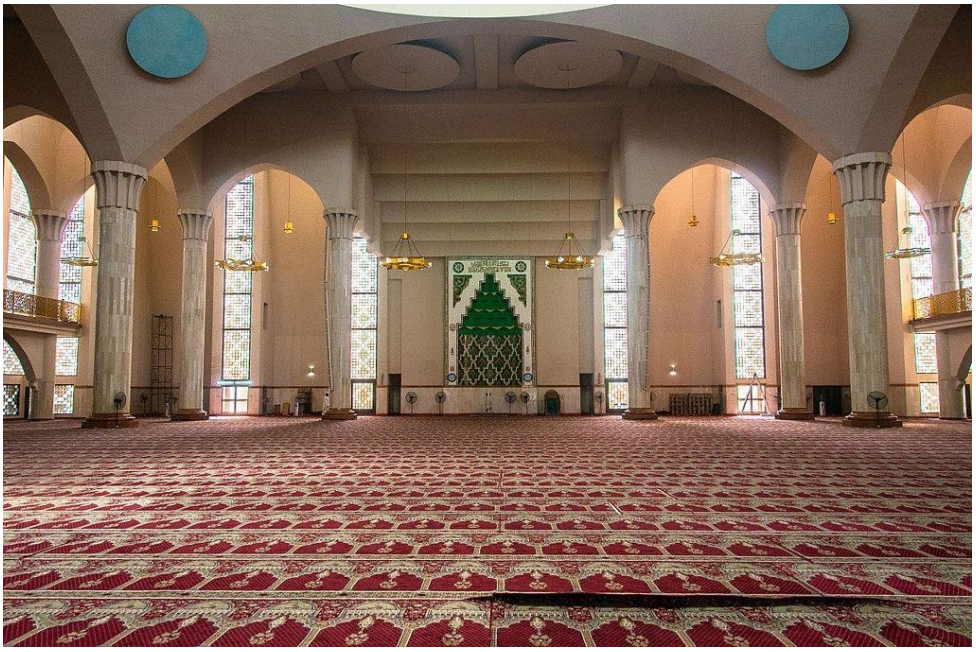

Figure 3: Interior view of the prayer hall, Source:Iqnar.com (2018)

Figure 4: Interior view of the prayer hall showing the upper floor where the women's section is situated, Source: Boomsbeat.com (2015)

These elements do not only enhance the aesthetic appeal of the mosque but are also vital visual representations of the Islamic teachings and values (Sulaiman, 2015). The mosque's prayer hall can accommodate thousands of worshippers, emphasising its role as a central hub for Nigeria's Muslim community. Its combination traditional Islamic designs and Nigerian architectural patterns the mosque comes out as a representation of Nigeria's multireligious status and identity, where these Islamic designs and Nigerian architecture styles have been seamlessly merged together. The mosque's construction design is a testament to the country's Islamic roots, and it symbolizes faith and unity in a nation characterized by cultural diversity.

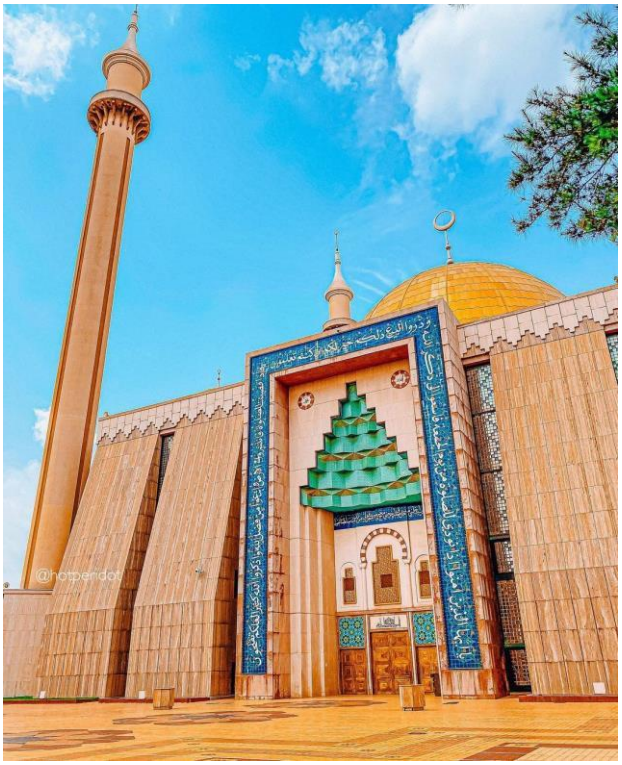

Figure 5: Facade of the mosque, Source: Outravelandtour.com (2015)

Ethics And Responsibilities

Some ethical issues are raised concerning the manner in which public funds are used for religious projects in the process of construction and the maintenance of the Nigerian National Mosque. Though this mosque shows how committed the government is towards religious inclusivity and national oneness, it still raises these concerns regarding just and fair distribution of resources among different religious groups. By making use of public funds in a way that is sensitive to and mindful of all religious communities, a sense of ethical responsibility is met by the Nigerian government in regard to its people (Williams, 2017).

The status of the mosque implies that it is essential for the mosque to contribute to the cause of inter-religious dialogue and peaceful coexistence. It is a platform in which respect and understanding among the different religious groups of Nigeria are promoted. Through the organising of interfaith events and discourse, the mosque becomes an essential player in enhancing social cohesion and peace in the society (Sulaiman, 2015). Its presence in the capital city expresses respect toward religious tolerance and constructs bridges between different communities.

Moreover, the mosque does not limit itself to religious duties but also shoulders some social and community roles. The place offers programs and projects on education in understanding religion and culture. In its outreach function to society and in the development of a caring attitude toward societal issues, the mosque discharges its ethical duty to make a positive difference in society (Zakari, 2016). This is very crucial to a nation that values religious pluralism and diversity.

Subjective Interpretation

Different audiences have different subjective interpretations about the Nigerian National Mosque. To Nigerian Muslims, it's a sacred place where they go for prayers, meditation, gathering and meeting others. It's a symbol of their faith and is considered as spiritual anchor in the city centre (Sulaiman, 2015). The Muslim community feels united by the presence of mosque that provides them an opportunity to reconnect with their faith and heritage.

The Mosque has drawn wide-ranging interpretations from different groups in Nigeria. It could be seen by non-Muslim Nigerians and foreigners visiting the country as a remarkable piece of architecture which also reflects the diversity of religions in Nigeria. Its imposing structure and elaborate carvings make people curious about its meaning within Nigeria's national and religious identity (Zakari, 2016). For some, it may represent Nigeria's artistic genius and rich cultural heritage while others may see it as a representation of the nation's dedication to religious tolerance and coexistence.

The mosque's design elements, such as the elaborate mosaics and expansive prayer halls, invite contemplation, admiration and reflection. They serve as visual narratives that communicate the spiritual and cultural values of Islam. These elements contribute to the mosque's role as a space for dialogue and understanding, encouraging visitors to engage with its beauty and symbolism on a personal and emotional level (Williams, 2017).

Identity Construction

The Nigerian National Mosque plays a vital role in the identity construction of Muslims in Nigeria. It is a tangible representation of their religion and cultural background, fostering feelings of being part of something bigger and having self-respect (Adegbite, 2010). Also, it contributes to the larger narrative of Nigerian identity which is built on religious multiplicity and pluralism.

This mosque's architectural design merges Islamic and Nigerian elements thereby buttressing the notion that there exists an all-inclusive national identity with respect for religious diversity. It also reminds about how rich in culture and historical heritage Muslim community of Nigeria is, pointing out its notable contributions to development and nation's history (Smith, 2012).

The presence of this mosque in the capital city is critical as it emphasises on religious diversities shaping the national identity. The importance of this mosque extends beyond just the Muslim population within Nigeria into encompassing the entire country. It represents Nigeria's commitment to religious tolerance and co-existence thereby embodying unity and inclusiveness (Zakari, 2016). By promoting a shared sense of belonging among people, it facilitates national storylines that celebrate diversity and embodies all religious groups.

Conclusion

From a global perspective, the Nigerian National Mosque is evidence of cultural and religious importance of the country. The house of worship attracts visitors and scholars from all over the world thereby signifying Nigeria's engagement with global Islamic community (Smith, 2012). Through its architectural design which mixes traditional Islamic elements with modernist principles, it has placed itself on a league of its own amongst other structures constructed globally.

Through various international engagements and dialogues by this mosque, Nigeria positions itself as a leading African nation within the Islamic context. It acts like a cultural representative showcasing Nigeria's great heritage as well as her contribution to global debates on religion, architecture or culture (Williams, 2017). By holding conferences/exhibitions at international level through such activities done by it makes Nigeria reiterate her commitment towards fostering global cooperation and understanding.

Moreover, the Nigerian mosques design embodies the fusion of global styles and local cultural values. This is a typical of how nations can mix internationally accepted architectural patterns with their specific socio-cultural backgrounds to come up with structures that are appealing and relatable to both local and global audiences (Adegbite, 2010). The international importance of this mosque highlights Nigeria as an exemplar of cultural dynamism and religious multiplicity.

The Nigerian National Mosque in Abuja is a large piece of public art engaging its environment and audience through representation , ethics , global relevance, subjective interpretation, and identity construction. It speaks of religious unity and cultural pride, reflecting the role that architecture can play in bringing about national and religious identity. The mosque is an embodiment of faith and one of strong expressions of culture that should be able to foster peace, understanding and harmony among the various communities in Nigeria.

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A COMPARATIVE ANALYSIS OF REPRESENTATIONAL STRATEGIES IN CONTEMPORARY NIGERIAN PAINTINGS OF EBENEZER AKINOLA AND SAM EBOHON

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Abstract
This paper explores the practice of Ebenezer Akinola born December 1, 1968, in Ibadan, Oyo state and Sam Ebohon, born November 30, 1970 in Lagos whose artistic production demonstrate an intentional and multilayered exploration of representational and abstract modes of expression. Adopting a qualitative methodology, this research integrates visual and semiotic analysis, supported by secondary literature derived from exhibition catalogues and critical essays. The theoretical approach draws on postcolonial theory, specifically Homi Bhabha's concept of hybridity, in combination with W.J.T. Mitchell's visual semiotics, to examine how these artists work to undermine conventional dichotomies between content and form. The findings reveal that figuration and abstraction are not only opposing strategies, but synergistic tools enabling Nigerian artists to convey ideas about identity, memory, and resistance to colonial narratives, Western aesthetic dominance, socio-political marginalization, and cultural erasure. Their vibrant, hybrid visual language reflect the intricacy of the modern Nigerian artistic experience.

Keywords: Figuration, Abstraction, Contemporary Nigerian Painting, Ebenezer Akinola, Sam Ebohon, Visual Semiotics

Introduction

Modern Nigerian painting is characterized by a vibrant syncretism of visual idioms drawn from indigenous traditions, postcolonial histories, and global concerns. Abstraction and figuration in this context operate not as binary opposites but as complementary modes towards expressing complex personal, political, and cultural meanings. The conventional dichotomy between figuration - as clarity and representation - and abstraction - as ambiguity and conceptualism - proves inadequate in the Nigerian context, where both approaches engage deeply with memory, narrative, and resistance to post-colonial narratives. Nigerian artists do not merely follow global art trends but reinterpret them through local knowledge systems and lived realities. Figuration, especially of the human form, often becomes a means of articulating identity, reclaiming history, and documenting everyday experiences (Okeke-Agulu, 2015). Abstraction, by contrast, enables a symbolic richness that invokes religious and cultural philosophies, offering meanings that resist simple interpretation (Enwezor, 2009). Artists such as Ebenezer Akinola and Sam Ebohon exemplify how figural and abstract approaches are not mere stylistic preferences but are rooted in deliberate cultural and intellectual engagement. Akinola's refined figuration dignifies Black subjects, imbuing them with emotional and psychological depth (Plate 1 and 2).

Plate 1: Ebenezer Akinola, The type of Gal your Papa Warned you about, 2023, Oil on Linen 40 1/5 × 34 3/10 inches. Source: https://www.artsy.net/artwork/ebenezer-akinola

Plate 2: Ebenezer Akinola, Good Gal...I, 2023, Oil on canvas 60 × 48 inches.
Source: https://www.artsy.net/artwork/ebenezer-akinola

In contrast, Ebohon employs abstraction as a method of evocation rather than literal representation, leveraging line, texture, and form to allude to spiritual entities, environmental processes, and collective memory (Plate 3). Although their visual tactics diverge, both artists engage the broader inquiry of how form and content intersect in the postcolonial Nigerian imagination.

Plate 3: Sam Ebohon, Baba 70, 2017, Oil on canvas, 50 × 50 inches. Source: https://www.mutualart.com

This paper investigates the application of figuration and abstraction in recent Nigerian painting as a means of expression, critique, and identity construction. Using Homi Bhabha's (1994) theory of hybridity, this study understands these visual devices as not rigid categories, but as areas of encounter where meaning is negotiated and reconstituted. Bhabha's "Third Space" theory is central to an understanding of how Nigerian artists negotiate their colonial heritage of visual categorization, thereby producing hybrid genres expressive of their multi-layered socio-cultural milieux. Furthermore, W.J.T. Mitchell's (2005) theory of the "pictorial turn" alerts us to the necessity of engaging with images as something other than representation, but rather as semiotic and cultural phenomena expressing themselves in complicated, often non-verbal manners.

Using a qualitative approach of visual and semiotic analyses of chosen paintings by Akinola – *'Let us go beyond this moment'*, 2023 and Ebohon, '*A Man Must Hold His'*, 2022 is ideal for exploring nuanced meanings, symbolic content, and contextual interpretations in artworks as it allows for interpretive depth rather than empirical generalization. The semiotic analysis digs into the *signs* and *symbols* in the paintings for instance the clothing, objects, gestures, background elements to interpret culturally coded messages and ideologies. This study draws on exhibition catalogues and critical literature to contextualize the work of Nigerian painters within a broader aesthetic and political discourse. Its aim is to explore how Nigerian artists strategically navigate the boundaries between figuration and abstraction to engage both local and global audiences. Significantly, it presents this meeting as a manifestation of decolonial praxis, demonstrating how such visual practices are not simply copies of Euro-American modernity but are, indeed, intended challenges to Eurocentric notions of form and artistic priority. Through these strategies, Nigerian artists claim their visual sovereignty by locating their practices within local histories, cultural memories, and socio-political conditions. The development of figuration and abstraction in Nigerian painting is therefore linked to the general intellectual and political history of Nigeria, more particularly as a reaction to colonialism and as a struggle towards cultural self-definition. An important event in this process was the establishment of the Zaria Art Society in 1958 by artists such as Uche Okeke, Bruce Onobrakpeya, and Yusuf Grillo. Their "Natural Synthesis" ideology sought to synthesize Western art training with indigenous traditions as a deliberate decolonial gesture (Okeke-Agulu, 2015).

In the early post-independence period, Nigerian artists used figuration - recognizable human or symbolic forms - to counter colonial portrayals of Africa as primitive or static, affirming African subjectivity and historical presence. While abstraction was not the dominant style, it was embedded within figuration through stylized forms and motifs derived from indigenous visual traditions such as Uli, Nsibidi, Yoruba carvings, and Islamic geometric patterns. These symbolic abstractions, even within representational works, reflected indigenous epistemologies and laid the foundation for later artists to more explicitly engage the interplay between figuration and abstraction within a decolonial context. From the 1980s onward, during the postcolonial and late-modernist era, Nigerian artists increasingly engaged with global contemporary art practices. The economic liberalization of the 1990s and the rise of international biennales expanded opportunities for critical experimentation and contributed to a growing embrace of abstraction as a mode of conceptual freedom and transnational relevance (Enwezor, 2009; Oguibe, 2016). However, this did not signal a rejection of figuration; rather, artists often recontextualized it to create new dialogues around hybridity, spirituality, gender, and memory. Central to this artistic shift is an ongoing debate in art theory over how to define abstraction and figuration without reducing them to simplistic binaries.

Figuration typically refers to artwork depicting recognizable subjects, especially the human figure, while abstraction prioritizes form, colour, and composition over direct representation (Chave, 1990). However, as W.J.T. Mitchell (2005) and Kobena Mercer (2008) argue, both modes carry significant ideological and cultural significance. In African contexts, abstraction functions not merely as an aesthetic choice but as a continuation of symbolic and non-verbal communication traditions found in textiles, religious iconography, and oral cultures.

Scholarly discourse on African art has largely emphasized ethnographic readings of traditional forms or celebratory accounts of modernist pioneers, often neglecting contemporary painters who blend figuration and abstraction. Olu Oguibe (2004) underscores the global positioning of African artists but focuses primarily on installation and conceptual art, while Chika Okeke-Agulu's (2015) seminal work on postcolonial modernism concentrates on earlier generations. As a result, there remains a critical gap in the analysis of how today's Nigerian painters, such as Ebenezer Akinola and Sam Ebohon, utilize representational strategies (Plate 4 and 5). Their practices resist rigid classification, instead reflecting a fluid negotiation of indigenous heritage and global artistic discourse - highlighting the need for more nuanced scholarly engagement with contemporary Nigerian painting affirmation, identity construction, and political expression.

Plate 4: Ebenezer Akinola,*I am Invincible*, 2023, Oil on Linen 52 2/5 × 56 7/10 inches. Source: https://www.artsy.net

Plate 5: Sam Ebohon, *John 15:4, 2022,* Oil on canvas 60 × 36 inches. Source: https://ebubay.com/

This paper addresses this lacuna by exploring critically how contemporary Nigerian artists use figuration and abstraction not just as aesthetic tools, but as modes of cultural translation, decolonial intervention, and visual experimentation. In doing so, it contributes to a more nuanced appreciation of the strategies through which artists negotiate tradition, modernity, and globality in Nigerian visual culture. In Nigerian painting, hybridity occurs through the vacillation between figuration and abstraction that cannot be read as a lack of stylistic commitment but rather as a strategic move for cultural negotiation. Ebenezer Akinola and Sam Ebohon work in this "third space" to produce works of art that are simultaneously deeply rooted in local iconographies and engaged with international artistic languages. Their visual language thus holds the substance of postcolonial processes and potential for innovation.

Ebenezer Akinola's *Kids of Paradise II* (Plate 6) operates within Homi Bhabha's "third space," blending local African traditions with global artistic influences to create a hybrid visual language. The painting portrays children as symbols of innocence and cultural vitality, rendered with luminous skin tones that reflect Akinola's signature style. While drawing on European classical portraiture, the work resists imitation, instead focuses on African identities and experiences. This articulates a postcolonial vision grounded in resilience, cultural continuity, and optimism, syncretizing Western naturalist tenets with Yoruba metaphysical concepts to challenge simplistic oppositions between indigenous traditions and modernity.

Plate 7 shown above depicts Akinola's painting titled '*The Kind of Gal Your Papa Warned You About'*, 2023 is an example of his use of Bhabha's "third space" via the synthesis of local Nigerian iconography and global art influences to venture into hybrid postcolonial identity. The artwork displays a self-assured and assertive woman who challenges patriarchal values, recasting a morally stigmatized individual into one of complexity and empowerment with a synthesis of structural complexity and African cultural themes. By incorporating elements taken from Western portraiture and photography, Akinola contests binary understandings. traditional norms and contemporary influences. Thus, the painting emerges as a significant location of visual resistance and identity negotiation in contemporary African art.

Plate 6: Ebenezer Akinola, *Kids of Paradise II*, 2023, Oil on Linen, 63 4/5 × 57 1/10 inches. Source: https/www.artsy.net

Plate 7: Ebenezer Akinola, *the kind of gal your papa warned you about,* 2023, oil on linen, 38 1/5 × 32 7/10 inches.
Source: https://www.artsy.net

Ebenezer Akinola's *'Merry Lady'* (Plate 8) is a fine illustration of Bhabha's "third space," in which the African identity is reconstituted in an amalgamation of local traditions and international influences and aesthetics. The piece combines Yoruba visual culture with contemporary fashion - cobalt blue hair, yellow hues, and bold red lips - conveying a strong woman who challenges stereotypic representations of African womanhood. Set against a bright yellow background, the portrait combines classical oil paint techniques with Afrofuturist and editorial styles embodying a dialogue between African self-portraiture and European portraiture. The subject's fashionable and assertive demeanor deconstructs patriarchal and colonial discourses, representing her as a symbol of urban modernity and cultural empowerment.

Plate 8: Ebenezer Akinola, *Merry lady*, 2023. Oil on canvas, 30 7/10 × 30 7/10 inches.
Source: https://www.artsy.net

Rather than overt political commentary, Akinola's postcolonial critique lies in how he reclaims representation. By focusing on a vibrant, self-styled African woman, he asserts aesthetic and cultural autonomy. '*Merry Lady' (2023)* thus, becomes a celebration of hybridity, identity negotiation, and the evolving image of Nigerian womanhood in the global age.

Mitchell (2005) in his concept of the "pictorial turn" advances the understanding of visual art by regarding images as active participants in cultural dialogue, rather than passive representations of reality. He argues that images possess an inherent logic and rhetorical force, capable of developing meaning independently of the text. Such an approach proves particularly useful for analysing abstraction (Plates 9 - 11), whereby meaning is conveyed by such things as texture, rhythm, and spatial distortion, along with the knowledge of figural compositions that look real but are embedded with culturally distinctive gestures, costumes, and visual codes. In this context, visual semiotics, enables a closer reading of how Nigerian artists express meaning through formal and aesthetic decisions.

Plate 9: Sam Ebohon, Wilderness of physical sensation. Oil on canvas, 2021, 50 × 57 inches. **Source:** https://ebubay.com

Plate 10: Sam Ebohon, Finding balance 1. Oil on canvas, 2022, 50 × 57 inches. **Source:** https://ebubay.com

Plate 11: Sam Ebohon, Wings of entwined souls. Oil on canvas, 2024, 50 × 57 inches.
Source: https://ebubay.com

The point of convergence between visual semiotics and postcolonial hybridity enables a more nuanced conception of representation in Nigerian painting, effectively dismantling simple natural binary oppositions. Furthermore, it illustrates how figuration and abstraction are not divergent paradigms; but they are complementary strategies by which artists negotiate identity, history, and power. This is particularly applicable in a postcolonial African situation in contexts where visual practices have conventionally employed both representational and symbolic modes, for instance, masquerades, mural painting, and textile design - to portray religious beliefs and social values (Drewal, 1992).

Case Study Analysis

Ebenezer Akinola: Figuration as Cultural Assertion

Ebenezer Akinola's work is strongly rooted in figuration, using the human body as a medium of cultural reclamation and identity assertion. His figural representations exceed depiction to act as political statements, embodying resistance to the erasure of colonial and postcolonial history of African corporeality. Based on Homi Bhabha's (1994) hybridity theory, Akinola's representations could be interpreted as existing within a "Third Space" - a cultural hybrid realm where African customs crossover with modern culture. His integration of rich, vibrant colours with conventional African designs creates a visual vocabulary that manifests the local cultural identity and engagement with contemporary global modernist discourse. Akinola also highlights the socio-historical conditions of the Nigerian people. His painting '*Let Us Go Beyond This Moment*' (2023) exemplifies these concerns, offering an examination of memory, identity, and hope in postcolonial Nigeria (Plate 12). Utilizing the conceptual framework established by Maurice Halbwachs' theory of collective memory, the work demonstrates how individual memories are formed through and embedded with broader cultural, ethnic, and national narratives.

Plate 12: Ebenezer Akinola, *Let us go beyond this moment*, 2023. Oil on Linen - 43 3/10 × 63 4/5 inches.| Source: https://www.artsy.net

According to Halbwachs (1992), memory is inherently social, and Akinola's work reflects this by transcending individual biases to arrive at a shared sense of collective historical awareness. The title '*Let Us Go Beyond This Moment*' heralds a shared urge to transcend beyond pivotal experiences, for example, colonialism, ethnic conflict, or civil conflict in Nigeria. Akinola's Afrocentric figuration, symbolic compositions, and narrative style place the canvas in the role of space for constructing and reactivating cultural memory. As a mnemonic image, the painting not only recalls the past but also makes possible its reinterpretation.

The figures represented, regardless of being solitary or subtly animated, serve as representations of the larger social collective, suspended between remembering and imagining. This agrees with collective memory's dual role both as a continuity of history and as a tool for cultural revitalization. Akinola's work is a type of visual resistance, highlighting the importance of recalling marginalized histories. By his portrayal of shared suffering, resilience, and hope, he contributes to both preserving and reshaping collective memory. Like Halbwachs' theoretical model, Akinola's canvas underscores the need to remember the past while also reinterpreting it through collective experiences and artistic practice.

Sam Ebohon: Abstraction as Memory and Spirituality

On the other hand, Sam Ebohon's paintings are abstract in nature, using non-representational form and texture to explore notions of spirituality, memory, and the fragmented nature of postcolonial identity. Ebohon's '*A man must hold his*' (2022), with gestural marks, organic forms, and layered texture, brings to fore the fragmented nature of history and memory when considering the African diaspora (Plate 13).

Plate 13: Sam Ebohon, *A Man Must Hold His*, 2022, Oil on canvas, 48 × 48inches,
Source: http://facebook.com/thefyxx

Mitchell (2005) perceives Ebohon's abstraction as a pictorial language that communicates intricate socio-political and historical discourses. Although his forms are not immediately recognizable, they call upon viewers to interact with the painting's symbolic depth. This process of interpretation captures the postcolonial subject's existence in fragmented and often conflicting cultural identities. In sum, abstraction serves as a medium where Ebohon addresses historical trauma and navigates the complicated interactions of identity within a globalized world.

Intersections and Divergences: Abstraction and Figuration as Complementary Strategies

Akinola and Ebohon's work reveals that figuration and abstraction are not opposing but complementary methods to examine cultural identity, history, and memory. Akinola uses figuration to affirm cultural and historical continuity, whereas Ebohon utilizes abstraction to explore the spiritual and psychological dimensions of life after colonialism. Both artists affirm African identity and become involved with decolonial discourse, mediating between tradition and modernity.

Figuration and abstraction are revealed to be fluid and hybrid, rather than fixed categories. Akinola sometimes introduces abstraction in his representational work, whereas that of Ebohon's abstraction tends to maintain figural elements, insisting on merging indigenous and global influences on modern Nigerian painting. Together, their practices illustrate how these visual modes serve as tools of resistance, cultural negotiation, and artistic innovation (Plate 14 and 15).

Plate 14: Ebenezer Akinola, Dreams in Red I, 2023, Oil on canvas 23 3/5 × 23 3/5 inches Source: Latitudes. https://latitudes.online/ ebenezer-akinola - dreams-in-red

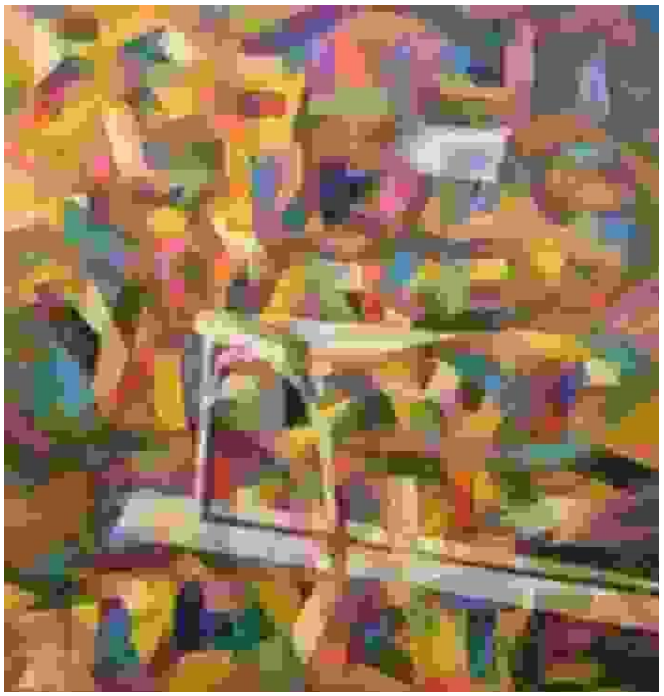

Plate 15: Sam Ebohon. Feel at home na aim dey make visitor spoil remote, 2022, oil on canvas, 48 × 44 1/10 inches. Source: http://www.artsy.net

Plate 16: Sam Ebohon, *flexibility*, 2018, Oil on canvas, 50 × 50 inches.
Source: https://www.mutualart.com

Collectively, these artists illustrate the vibrant and multifaceted personality of modern Nigerian painting, where figuration and abstraction are not binary opposites, but rather complementary approaches through which artists negotiate the complicated realities of cultural identity, memory, and history in a postcolonial context. The case studies of Sam Ebohon and Ebenezer Akinola reveals how figuration and abstraction function as complementary and interwoven strategies in contemporary Nigerian painting. Akinola uses figuration to affirm cultural identity and historical continuity, while Ebohon's abstraction engages with memory and identity on a personal and spiritual level. Rather than operating in isolation, their creative approaches reveal a fluid quality and dynamism, integrating traditional motifs, expressive realism, modern abstraction, and symbolic imagery into cohesive visual languages. The artistic practice of these individuals demonstrates the conscious integration of indigenous and external influences. Akinola integrates naturalistic portraiture with African iconography, and Ebohon combines abstract forms with cultural narrative inspired by indigenous histories. Through these strategies, both artists forge adaptive strategies for surviving postcolonial realities and hybrid identities. They transcend binary oppositions between tradition and modernity, figuration and abstraction, local and global by transforming art into a cultural convergence zone where evolving African identities are not only depicted but actively shaped.

Conclusion

This project explored the dynamic relationship between figuration and abstraction in the practice of modern Nigerian art, in the case of Ebenezer Akinola and Sam Ebohon. It showed how both artists employ these visual strategies to engage with and operate on notions of postcolonial identity, memory, and historical representation. Akinola employs figuration to stake claims of cultural continuity, while Ebohon employs abstraction to engage the psychological and spiritual facets of the postcolonial situation. Collectively, their works demonstrate that abstraction and figuration are not contradictory but rather complementary modes that respond to the complicated realities of African existence. Beyond visual choice, their paintings constitute a strong practice of resistance and decolonization, questioning colonial legacy while claiming visual sovereignty. Ultimately, Akinola and Ebohon demonstrate that Nigerian art of today is making a significant contribution to the global cultural discourse, and that the tension between figuration and abstraction will persist as a vital strategy in expressing postcolonial complexities of African art.

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EL ANATSUI'S RECENT WORKS: THE INSIDER'S INSIGHTS

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Abstract

A lot has been written about El Anatsui, ranging from a Sculpted History of Africa to a repertoire of lengthy essays, especially on his bottle-top works. The method of observation these essays is mostly second-hand. El seldom talks about his creative process. Most researchers anchor their enquiry on sometimes erroneous speculations. As a septuagenarian, the prevalent assumption is that most of his works are left to the mercy of studio hands. This is surprisingly not so. So, what happens in the Afrika studio? What salient or perhaps silent studio culture culminates in his enviable success? Embodied in this paper is a pictorial or somewhat visual dairy , or a somewhat visual diary, of his Africa Studio from the eyes of the participant observer.

Key Words: Studio Culture, Aluminum, Material Sourcing, Bottle Tops, Sculpture, Rendition and Style.

Introduction

Often referred to by the workers in his Afrika Studio as nd'mma (spirit) or named after such mysterious deities as Ndeke Udele, El Anatsui is an enigma. The numerous accolades to his person and the fixtures of his works have made him a household name in the creative circle. His emergence as an artist in post-colonial West Africa presented him with enough stories accruing from African experiences, which his audience interacts with in his installations. He uses poor materials in telling rich stories. Stories with -connections with the materials and creative process.

El Anatsui was born in 1944 at Anyako, Ghana. He was born into a polygamous family of thirty-two children. His art training was at the College of Art, now part of the Institute of Science and Technology, which is now the University of Technology, Kumasi, Ghana. His affiliation with the Nsukka Art School began with his arrival in Nigeria in 1975. His earlier media include clay and wood. Vogel (2012:34) notes that his move to Nigeria cut him off from local craftsmen and assistants with whom he had been working on his trays in Ghana. This gave him a new vista and he was in search of other means of representation. One sees the effect of culture in his works. As Littlefield (1999:189) puts it: "…he shares a strong commitment to working with an African visual grammar and extending it into new techniques and media. He started cutting wood with power tools and pyrographing it with pressure torches. In recent times, he has taken to installation Art. His exploration of bottle tops is sometimes intimidating in its dimensions. Some of his works draw inspiration from woven cloths such as *kente* cloth, which speaks volumes about his background. Having come to Nsukka, the prevalent Uli and Nsibidi, as well as the crux ideologies of the Nsukka Art School, became composite idioms alongside Ghanaian motifs. El Anatsui is one of the most inspiring artists of our time. He has had an exemplary forty-year career as both artist and art teacher. Anatsui has used his works to address a wide range of social, political, and historical issues in Africa. He has equally explored a diverse range of media and processes in his exciting career. He, and various power tools. The most significant part of his creative process is the sewing used in the composition of the bottle tops. His most outstanding approach is the re-purposing of media. This media range from: cassava graters, wood, metal tins, printing plates, to aluminum bottle-tops. These sculptures have been collected by major international museums such as the British Museum in London, the Centre Pompidou in Paris, the de Young Museum in San Francisco, the Smithsonian Institution in Washington, and the Museum Kunst Palast in Düsseldorf, among others. Some of his wave-making works are: *Fresh and Fading Memories (2007), In the World, but Don't know the World (2009),* Ozone Layer, Yam Mound, Broken Bridge I (2012), Broken Bridge II, TSIATSIA – Searching for Connection (2013) exhibited: during the 2007 Venice Biennale on the historic Palazzo Fortuny; the Dubai Art Fair, 2010; the Old National Gallery of Berlin (2010); the Musée Galliera, Paris, New York, (2012/13), and the façade of the Royal Academy of Arts, London, during its 245th Summer Exhibition, respectively. The most intimidating piece is TSIATSIA- Searching for Connections. After its exhibition at the Royal College of Art London, he was awarded the prestigious Fellowship of the Royal Academy of Arts. When confronted with the question of his creative process, El would sometimes say, "Ask Uche".

Who is Uche? Uche Onyishi read sculpture under Anatsui at the University of Nigeria, Nsukka, where he now teaches. He started working with El as an undergraduate but joined him as the studio manager in January 2007. As a native of Nsukka, he is conversant with the environment and the people. The recruitment of workers and day-to-day management of the Africa Studio is delegated to him by El. Apart from El, he is another person who knows the works and the installation format of El's works. He is occasionally delegated to museums and galleries abroad to mount works in readiness for exhibitions. Vogel (2012:6) lends credence to Uche's being an insider. In her words: "Onyishi Uchechukwu, Anatsui's studio manager, was unfailingly informative and helpful"

Vogel on El

It is no secret that El Anatsui has garnered worldwide recognition while working in Nigeria for over three decades. He is best known for the painterly draperies made from liquor bottle tops. These are in collections of many of the world's great museums. Susan M. Vogel has worked closely with Anatsui while directing an interesting documentary piece about El. She attempted to open up a distinctive

personal aspect of El Anatsui and provides a somewhat detailed study of his artworks. This study is enriched with several images of El and his works. The crux of this book is the critical presentation of El's lifelong exploration of diverse media culminating in the bottle top art form that has made waves mostly in recent times. In the book, an analytical inquiry into the themes of disorderliness, pain, truncated history, colonisation, and post-coloniality is explored as they affect his work.

The author's efforts notwithstanding, there would be little need for amendments to her data presentation to agree with the available facts from the diaries of the Africa Art Studio. These are enumerated thus:

On page 74, the author recorded that one of the designs, titled Chain, was developed in 2006; however, it was developed in 2007. Also, on page 75, "Four Corner Without Holes" and "Four Corner With Hole" were recorded as developed in 2006, but the development year was not specified. However, the development year was 2007. On the same page, another design titled "Flower" was developed in 2008, as opposed to 2009, as recorded in her book. The study did not include most of the designs developed during the author's research period.

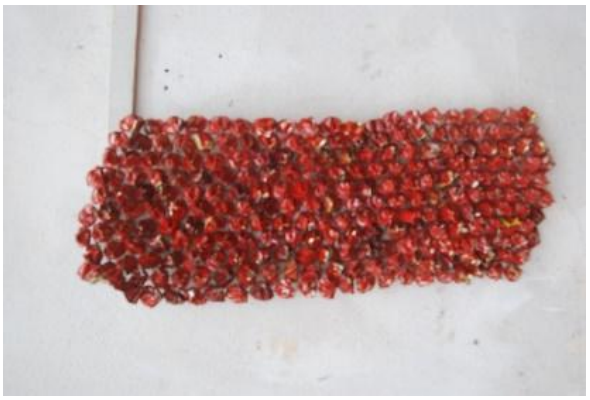

Plate 1, Egg Crate, Photos: Uche Onyishi

Plate II
Scatter 2007
Photos: Uche Onyishi

Plate III
Designer 3
Photos: Uche Onyishi

"Anatsui stays in touch with Uche by telephone when he is travelling, and the studio assistants continue to make the basic building blocks he will need for the hangings he has in mind" Vogel, 2012:68). The foregoing is true but does not capture the scope of communication between El and Uche. Such interactions via which often include sketches and photographs, are a more effective communication method used by the duo. These present a rich exchange between El and Uche, which are viable means that keep El in touch while on the go. There are several designs whose pictorial exchanges and modifications are done via email.

The Igbos have a proverb that says, "When the egg breaks, the palm nut falls, and the stone feels shy." One would expect academics, art historians or art critics who are colleagues of El at the Nsukka art school to have taken the giant stride Vogel took. To this end, Vogel deserves to be held in high esteem and remains an undeniable authority on El.

Administrative Organisation of the Afrika Studio

El is the Chief Executive of the studio. Assisting him is Uche Onyishi, the studio manager. The studio hands share the same rank irrespective of one's time of employment. The manager makes the payment schedule based on his daily record of events. El, who often makes the decisions and communicates, and most of the time, communicates them to the assistants through the manager.

There exist rules and regulations which include:

- Stealing attracts expulsion (no recall)
- Raining abuse on a fellow assistant attracts suspension.
- Fighting attracts expulsion
- Lateness is counted as absence
- One is free to quit at any time
- Consistent misuse of materials attracts a surcharge.
- No drinking or smoking in the studio; defaulters are suspended.
- Idling assistants are sent home
- Any assistant who comes to the studio while on suspension would be sacked.
- Studio is out of bounds to non-Africa-Studio members, unless visitors on appointment

The Making of an El

The making of an El revolves around two hints: inspiration and routine. El, who leads the design team, creating sketches and directing its development at times. ElEl also makes sketches and oversees their development at times, while others make sketches and direct their growth. Though sketching is seldom. The manager is privy to the modifications made at this stage. These activities are domiciled in the office. This is preceded by the formulation of these patterns in distinct blocks. The prototype blocks are a prerogative of the master himself, or sometimes through his directives to

the studio manager. These patterns or blocks are shown to the assistants to be expanded or developed into several larger formats. Afterwards, the composition of the blocks is achieved by laying out the patterns on the floor. Whenever inspiration strikes, prototypes are made and kept in readiness for eventual production. Whereas it is the routine that takes care of amplifying the designed blocks. Whether the master is there or not, the workers have a developed block to expand. The Africa studio has no dull moments. In creating joining, the primary choice elements and designs are laid side by side by the assistants, creating aquifer or rivulet-like gapes which are filled with brilliant colours to accentuate the piece. If El is uncomfortable with the piece, the part would be cut off, turned in another direction, or kept as "ngwongwo" (pieces of interlaced cut-off elements). This may later be used to develop another work. Another way to initiate a joining is by bringing together the secondary or second stage joining. These are the primary elements made into larger blocks, which are ideal for large-scale joining. Crevices are created rivulets, which are tapered and highlighted with brilliant or rare colours, much like a bottle top. These colours are always kept handy for this purpose in small formats. When the work is declared finished by El, it goes into the stage of strengthening. Strengthening can be done with an already made crumple line or grid, also known as a chain. This could also be done with chicken wire mesh at the back of the work. The last stage of strengthening is the fortification of the areas used for hanging usually at the top and bottom, or at the location that should be creased to avoid tearing. Testing of the strength is done at this stage. The workers do this by encircling the work and pulling to identify areas of weakness. The works are then washed with soap and water, dried and amended. At this juncture, the work is ready for packaging. After the final review, the works are signed and packaged for delivery. It is important to note that even when works are declared finished and signed, they can be reviewed. Works that have gone on exhibition could be reviewed or reconstructed, giving them a new look. Many works are kept at developmental stage, pending when ideas come, which could take weeks, months, or even years.

Plate IV: Conveying the Bags to the Vehicle

Plate V: Loading Into A Vehicle

Plate VI

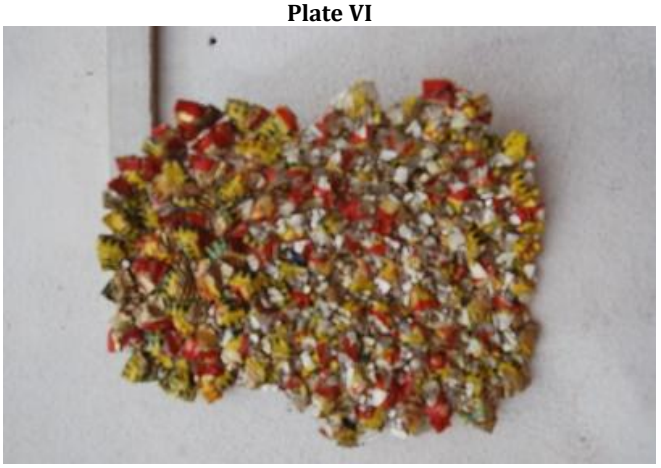

Plate VII

PLATE VIII

Plate VIV

PLATE X

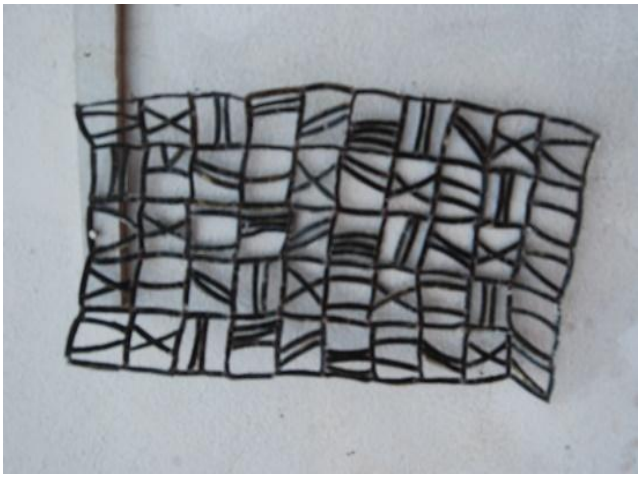

Plate XI

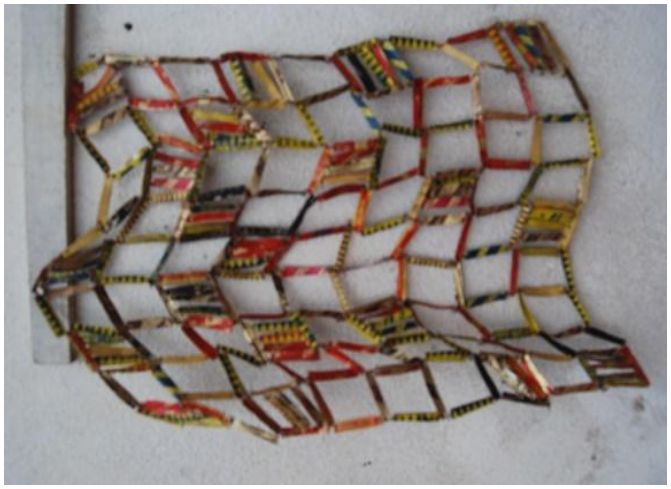

PLATE XII
Plates VI—XII: Block Samples
Photos: Uche Onyishi

A Peep into the Afrika Studio

Plate XIII: Work in Progress

PLATE XIV: JOINING

Plate XV: El on the

Plate XVI: Close view of the joining

Plate XVII: El directing the joining

Plate XVIII: Joining a large format

Plate XIX: Strengthening

Plate XX: El supervising his work

Plate XXI: El making the composition

Plate XXII: Joining

Plate XXIII: Shielding from the sun

Plate XXIV: An assistant's improvised footwear/soothes the sole and is bottle-Friendly
Photos: Uche Onyishi

Packaging

Plate xxv

Plate xxvi

Plate xxvii

Plate xxviii

Plate xxvix

Plate xxx

Plate xxxi

Plate xxxii

Plate xxv: El, taking a photograph of his work
Plate xxvi: El Studying the layout of a building for a proposed installation of his work
Plate xxvii: Gemirald Movers Packaging Some Works
Plate xxiii: Gemirald Movers Packaging Some Works
Plate xxiv: Gemirald Movers Loading Some Works
Plate xxix: El Mounting His Work
Plate xxx: Plate El Making Some Finishing Touches on His Work Mounted at Royal Ontario Museum, Toronto, Canada
Photos: Uche Onyishi
Plate xxxi: Uche Installing Open (ing) Market at Royal Ontario Museum (Photo: Dr Silvia Foni)

Workers' Welfare and Warfare

The wages of workers are paid according to the measure of work done. One could spend the same hours with a fellow worker and earn different wages. This encourages competition and increases productivity. The design units are shared in blocks. A block is a unit of a composite design. A block pattern is unique and designed for a particular work, intended for a specific purpose. What differentiates a block from the other could be a method of sewing using copper wire. It could also depend on the manner of handling, ranging from flattening and squeezing to pattern layout. The amount paid per block depends on the design pattern, thus the intricacies involved in actualising it. Complex patterns attract higher remuneration. The wages are substantial and attract several applications from individuals seeking employment. After the individual blocks are made, the composition follows. This state of joining attracts even/equal wages among the workers. This is because it is difficult at this stage to ascertain the unit contributions. As time goes on, wages paid per block are adjusted to account for growing inflation.

Most of the studio hands are secondary school leavers who seek admission into tertiary institutions. This is responsible for the fluctuations in the number of workers, since those who gain admission leave on a temporary basis. While on holiday, a worker who was once a part of the Afrika Studio could be reinstated for the holiday period. So, Africa Studio also offers long-term vacation jobs to students. The relationship between El and his workers could be likened to that of a father and his sons. It is a family. As a way of encouraging the workers to aspire beyond the wages, a grant is usually given to anyone who gains admission into a higher institution.
a longer duration to be finished, a flat rate is paid to all workers to enable them to pay their bills pending the completion of the work, thus ensuring full payment. In a month, a diligent studio assistant could earn an equivalent of a graduate's salary, if not more.

El is a silent philanthropist who shares in the joys and sorrows of anyone who experiences him, especially his workers. He pays the bills of many students and empowers artisans with machinery and tools without making a fuss, benefiting numerous students and artisans alike.

However, the recent surge in his career in terms of sales generated a sense of restlessness among the workers. The internet-savvy young minds see online the news of the high sales and presume they ought to have more wages, perhaps commensurate with the sales, rather than their work. The few members organised themselves with the intention of possibly getting more or supplanting the manager, whom they presumed might be the reason they were not receiving higher wages. This resulted in a strike action in March 2015 when El was out of the country for an exhibition. While waiting for El to come home with a solution, six new people were employed to avoid failing to meet a deadline.

Upon El's arrival, one of the striking workers attempted to hand him a note outlining their grievances. El refused to collect the letter directly from the delegate, insisting it must pass through the chain of command—the manager. To their utmost disappointment, the letter was handed over to the manager who read and handed over same , who read it and then handed it over to El. The write-up bore some allegations, mainly against the manager. Their thinking was that when El pays advances for uncompleted works, he does not deduct the same from the eventual full payment. However, in adherence to the manager's advice, El called a meeting of all assistant managers. He then disabused their minds and laid bare the fact that he deducts the advances before issuing any cheque to the manager. He forgave the erring group and vindicated the manager on all the issues raised. So, it is not always rosy. Like any other organisation, there are moments of tension, but the moments of amicability surpass them.

- Why did El not take the letter from the workers directly?
- What lessons abound in having a backup plan and a cane and carrot approach?

Perhaps there are lessons to be learned from El's administrative prowess. Perhaps he brings his University administration skills to bear in the studio management.

Conclusion

"Art media, in recent times, have been radicalised to the extent that the artist rose from using non-conventional materials to being the material itself in artistic renditions" Onyishi E.O., 2023:34). There tends to be in recent times some blurring margins among conventionally distinct art professions (Onyishi E.O., Agbor NJ & Ochini EO, 2024:1). El Anatsui's works reinforce this premise. The synergy between textiles and sculpture is exemplified in this. "There is conscious effort on the part of the artist to have his actions culminate in beauty. Onyishi E.O. and Onyishi UC (2025:70). The bottom line is that he leaves the outcome for the audience's imagination.

Like Onyishi E.O. & Onyishi U.C.E.O. & Onyishi U.C.E.O. & Onyishi U.C.E.O. & Onyishi U.C.E.O. & Onyishi U.C. (2018:87) query "Who is an artist in the face of this eclectic milieu and what makes him one?" The study of El provides a vital response that expresses a constant hunger that should define an artist. El's journey is that of a consistent and dogged search laced with determination. Whether something or an event is coming up or not, he continues to work. When inspiration is going, lacking inspiration, routine keeps the work moving forward. No day passes without him working on his art. He has a total commitment to his art and exhibits high administrative prowess.

If anybody is humane, amiable yet strict and persistent, it might not be wrong to refer to such a person as an El.

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AAFIN OBA AKARIGBO OF REMOLAND: AN EXEMPLAR OF IMPROVED ARCHITECTURAL DESIGN AND EMBELLISHMENT IN RECONSTRUCTION

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Abstract
Aafin Oba, also known as the royal Palace, across Yorubaland, Southwest Nigeria, and several ancient and traditional architectural sites are disappearing due to various factors. While modern buildings are replacing some of this conventional architecture, others have become extinct. An example of traditional architecture that has been replaced by modern architecture was the old Palace of the *Akarigbo* of Remoland, which was destroyed by irate youths who set it ablaze in 2003. The Palace has been rebuilt with an improved architectural design that aligns with the Yoruba age-long adage, "*Ile Oba to jo, Ewa lo busi*," meaning that an *Oba's* Palace, razed by fire, will eventually regain its beauty. This paper took into account the components of the old Palace based on an oral account. It documented and analysed the components of the new *Akarigbo's* palace architectural design in Sagamu, the socio-cultural and political headquarters of Remoland. The paper examined the paradigm shift in the architectural design of the Palace. The paper concluded that art and architecture are like conjoined twins. The paper recommended an urgent need to document other existing traditional and historical architecture for record-keeping purposes and to educate future generations.

Keywords: *Aafin, Akarigbo*, Royal Palace, Architecture, Decoration, Yorubaland

Introduction

Aafin in Yorubaland refers to the official residence of the monarch (*Oba*), also known as the Royal Palace. The community typically constructs it to accommodate the *Oba* and his immediate family, as well as some palace staff. However, in communities where they do not have a community palace, the *Oba's* private home or family house is also regarded as *Aafin*. Thus, in this paper, *'Aafin*' and 'Royal Palace' will be used interchangeably.

Several ancient or traditional architectural sites, particularly *Aafin Oba*, across Yorubaland in Southwest Nigeria, are disappearing due to various factors, including destruction caused by both natural and artificial occurrences. Although modern buildings are replacing some, others have gone into permanent extinction. One typical example of traditional architecture being replaced by modern architecture is the old Palace of the *Akarigbo* of Remoland, a subgroup of the Yoruba people.

Adekoya (2024) observed that modern palace architecture is rapidly becoming a tradition or common practice among various towns and communities, both small and large, in Yorubaland, with each constructing a befitting residence for their monarch. Adekoya noted further that shortly after the Yoruba had contact with the Western world through the returnee enslaved people from Brazil, British colonialism and its antecedent's civilization, education and modernization, the Yoruba royal palaces began to experience various kinds of changes and transformations which affected almost every aspect of their architecture – sizes, designs and materials. Consequently, some have been demolished and rebuilt, while others have been relocated or renovated with modern materials. This is the situation with some palaces in Ogun State, Southwest Nigeria, where an *Oba's* Palace had been demolished by irate youth but has been rebuilt by the community. Some have been relocated due to inadequate space in their former location and/or expansion. In contrast, others have maintained the trends of their palace architecture, ensuring that all the structures built since inception have remained intact to this day. They did this for the education of the people and their yet-unborn generations.

Brief History of Remo/Sagamu

Remo is the smallest that make up Ogun State. Remoland is situated in the Southwestern part of Nigeria. It has three out of the Twenty Local Governments in Ogun State, namely, Sagamu Local Government, Ikenne Local Government and Remo North Local Government. It is bounded in the North by Obafemi-Owode Local Government of Ogun State, with Owode-Egba and Obafemi villages, and in the Northeast by Ijebu North Local Government of Ogun State and Ago-Iwoye villages. It also has a boundary with Ikorodu Local Government in the South-East with Agbowa-Ikosi towns and Ikorodu villages and is bounded in the East by Odogbolu Local Government of Ogun State with towns like Ijesa-Ijebu, Okun Owa, Odogbolu and Aiyepe as boundary mates and also has a boundary in the Southwest with Ifo Local Government with Isheri town and villages.

Akarigbo is the title of the *Oba* of Ofin Sagamu. He is also the Paramount ruler, the sacred and spiritual head of the thirty-three (33) traditional towns that make up Remoland. According to Chief Abdulrasak Adeyemi Salami, the *Lisa Akarigbo* of Remoland, Sagamu, is a conglomeration of thirteen quarters or settlements founded in 1865, with each quarter or settlement having its separate and autonomous *Oba*. Corroborating Chief Adeyemi's opinions above, Ayodele (2008) posited that these quarters decided to merge and form an indivisible entity as a result of incessant attacks by their Egba neighbour during the intertribal Yoruba war. The thirteen quarters, mainly located in the southern part of Remo, are Ofin, which produces the *Akarigbo*, Epe, Makun Ibido, Sonyindo, Batoro, Oko, Ijoku, Ado, Latawa, Ijagba, Ipoji, and Igbepa. Other Remo towns that occupied the central division (Ikenne, Ilisan, Irolu, Iperu, and Ogere) and those in the northern part (Ipara, Isara, Ode, Akaka, and Ilara) have remained in their original locations to date.

Historical Purview of the Trends in the Palace of *Akarigbo* of Remoland

Akarigbo Palace is situated in the town of *Ita'Oba*, Sagamu. The Palace formerly shared a parcel of land adjacent to the Ogun State University Teaching Hospital (OSUTH) in Sagamu with the Ibadan Electricity Distribution Company (IBEC) and the Sagamu Local Government Secretariat. However, the palace grounds now extend to the section formerly occupied by the Sagamu Local Government Secretariat, which has been relocated to its permanent site along Sagamu/Aiyepe Road, Sagamu. The new *Akarigbo* Palace can be described with the popular Yoruba age-long adage that says, *"Ile Oba to jo, Ewa lo busi"* (literally meaning) an *Oba's* palace razed by fire will eventually gain beauty".

The reason, according to *Omoba* Biola Ogundeko, is that the Palace, which was recently rebuilt, is larger/bigger and spacious and looks more beautiful, modern and befitting than the old and former Palace that was razed to aches by angry youth in 2003 during the reign of *Akarigbo*, *Oba* Michael Adeniyi Sonariwo, *Erinjugbo* II. Interestingly, the new Palace is built on the same parcel of land but not on the exact spot where the former structure was demolished. The former location is now being used as an open courtyard in the palace premises.

According to an oral account from the Palace of *Akarigbo,* the old *Akarigbo* Palace was built over a century ago, specifically in 1920, by the Ijebu Native Administration during the reign of *Akarigbo* W.C. Adedoyin, who was installed in 1916 and reigned until 1952, when he passed away. There was a constant renovation of the old Palace, which was also used by the succeeding *Akarigbo* who reigned from 1952. For instance, *Akarigbo* Moses Sowemimo Awolesi, who reigned from 1952 to 1988 and *Akarigbo* Michael Adeniyi Sonariwo, who was installed in 1990 and reigned till July 16, 2016, used the old Palace. It was during the reign of *Akarigbo* Michael Adeniyi Sonariwo, *Erinjugbo* II, precisely in 2003, that irate youths razed down the sacred Palace of the Akarigbo. Information from the Palace indicated that all archival materials, records, pictures, and other cultural items in the Palace, which would have been of immense assistance and contribution to research on the Palace, culture, customs, and traditions of the Remo people, were burnt or destroyed alongside the razed Palace.

In 2004, the launch of the new *Akarigbo* palace was held. Interestingly, the new Palace is built on the same site where the old one was demolished, albeit with an extension. The new Palace now occupies the space where the Sagamu Local Government was formerly located before it moved to its new location on Sagamu/Aiyepe Road. The Palace is built in two (2) phases: the administrative blocks and the *Oba's* residence. The people built the administrative blocks, while the *Oba's* residence, according to *Omoba* Abiola Ogundeko, was built by Chief Kesington Adebukonla Adebutu.

Structural Components of the Newly Built *Akarigbo's* Palace

Ile Oba to jo, Ewa lo bu si is a Yoruba parlance that is used to describe the beauty/aesthetics of something (animate or inanimate objects; man or woman, vehicle, house) that is newly acquired, produced, purchased, or rebuilt after the old one was destroyed either by man or consequence of natural disaster. However, the parlance in the context of this paper is used to describe the beauty, aesthetics, and adornment that enveloped *Akarigbo's* Palace, which was newly rebuilt following its destruction by irate youths who set the *Aafin* ablaze in 2003.

The need to document the existing structural components of the newly rebuilt *Akarigbo's* Palace arises from the fact that the old Palace, which was razed by irate youth in 2003, was not photographically documented. This made it extremely difficult to have any tangible information about the old Palace. Egunjobi, Adeniji, and Adisa (2023) observed that numerous architectural edifices exist across Nigeria, although modern buildings are replacing some, resulting in their disappearance. This, therefore, calls for an urgent need to document the existing building about its future. Egunjobi et al. (2023) also cited Omole and Ogundiran (2011), who observed that the phenomenon of conservation is virtually new in the developing world but has been given wide attention in the developed world. Egunjobi et al. (2023) affirmed that in almost every settlement in Nigeria, buildings of historical importance are under threat of either destruction or replacement with imported Western technology and culture.

Omale and Ogunmakinde (2018), as cited in Egunjobi et al. (2023), posited that one of the qualities of good architecture is its visual appeal. Thus, architecture relies on visual arts as the primary faculty for its aesthetic communication. Egunjobi et al. (2023) asserted that the relationship between art and architecture is an age-long phenomenon. They cited Adegoke (2015), who stressed the importance of ornamentation as an embellishment of daily living and claimed that ornamentation could be iconographical, referring to the application of ornaments on objects and people, or it could be applied to achieve an overall beautiful outlook.

There are nine (9) structural components in the new *Akarigbo* Palace architectural design located at *Ita'Oba* in Sagamu. The primary structures include the Gatehouse, the Generator house, the Royal Initiative for the Development of Sagamu Community (RIDSCO) building, the Main Office Building/Administrative or Office Complex, *Oba's* primary residence, Lawn Tennis Court, *Akariagbo* Entourage Staff Quarters, Security post, *Akarigbo* Palace Hall, Ogun State Council of *Baales* Building, and an Open Courtyard. Virtually all the structural components of the palace architecture were newly rebuilt, except the building occupied by the RIDSCO, which was the only building that was not touched by the irate youths among the old palace buildings and the Cenotaph. However, it is worth noting that there are other components within these structures components. For example, the Main Office Building houses the *Akarigbo's* Office, Administrative Office, Remo Royal Traditional Hall, *Akarigbo*-in-Council Hall 1 and Hall 2 and the Museum/Library. Similarly, the *Akarigbo's* primary residence houses other components, including the *Oba* and his immediate family's apartment, the Banquet hall, the Presidential Lodge, and the V.I.P. Lodge.

The *Akarigbo* Palace Fence and the Gate House

In the ancient period, the fencing of the Palace was part of the traditional Yoruba architectural design. In the ancient Yoruba period, the fence was called *Odi*. Dmochowski (1990), as cited in Adekoya, Bada, and Adenle (2014), described the walls of the ancient Yoruba palace as having an average thickness of 0.6 to 1.0 meters (approximately 2-3 feet) and a height of about 2.7 to 4.4 meters. Dmochowski (1990) noted that they were built in layers and had thick walls and courtyard corridors that were decorated with relief carvings and carved posts. The *Akarigbo* palace is fenced around, with three of its sides (right, left and back) walled with concrete blocks. The fence is approximately 10 feet high to shield the activities in the Palace from public view. At the same time, the whole length of the front wall is done with fabricated iron bars. The iron bars are arranged vertically with a space of about four (4) inches in between them (Figure 1).

There are six (6) gates strategically positioned around the fence. Two of the gates are positioned on the front wall (Figures 2 and 3) and are designated for the inward and outward movement of people and vehicles. The front gates are also fabricated in the same manner as the front fence. There are two other gates on the left side, one of which opens to the courtyard behind the Administrative Building, and the second one opens to the *Oba's* primary residence. The fifth gate is on the right-hand side of the fence along *Ita'Oba*/Olabisi Onabanjo State University Teaching Hospital (OOSUTH) road that opens to the parcel of land where the Sagamu Local Government Secretariat was formerly located, but now being occupied by the *Akarigbo's* palace hall and the Ogun State Council of *Baales* building, while the sixth gate is on the fence that separates the Administrative/Office building from the *Akarigbo* primary residence and links the open courtyard to the *Akarigbo* main residence. These last three gates are fabricated with iron metal sheets, solidly integrated with the fence itself, also to conceal the Palace.

There is only one gatehouse at *Akarigbo* Palace, even though there are six gates positioned around the Palace. The gatehouse (Figure 4) is a minimal structure attached to the front fence, very close to the Exit gate (Figure 2). It is located on the right-hand side when exiting the Palace. The gatehouse houses the security personnel who coordinate the inward and outward movement of people and vehicles to and from the Palace. It is constructed in a way that provides convenience, allowing security personnel on duty to quickly use the restroom and return to their duties without delay.

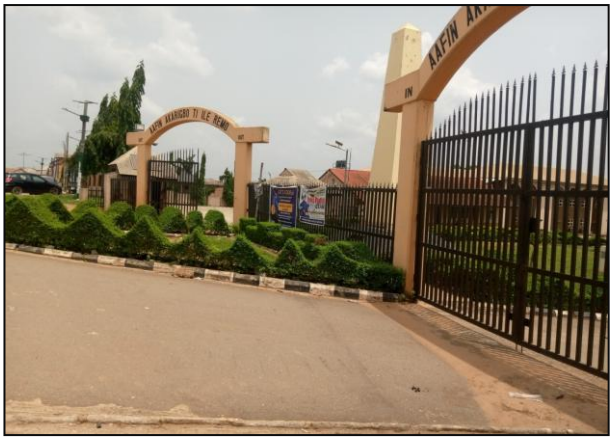

Figure 1:
The front Fence at *Akarigbo's* Palace
Source: Samson Kehinde Adekoya (2022)

Figure 2:
,The Exit Gate at *Akarigbo's* Palace
Source: Samson Kehinde Adekoya, (2022)

Figure 3:
The Entrance Gate at *Akarigbo's* Palace
Source: Samson Kehinde Adekoya (2022)

Figure 4:
,The Gate House at *Akarigbo's* Palace
Source: Samson Kehinde Adekoya, (2022)

The Generator House

The Generator House (Figure 5) is a very small, simple, and rectangular structure built very close to the gatehouse and the RIDSCO building. It is an enclosed structure with three sides built up with perforated blocks, presumably created to allow the escape of flame emanating from the generating set. The fourth side has a small iron gate centrally fixed to it for in and out movement.

The Royal Initiative for the Development of Sagamu Community (RIDSCO)

The Royal Initiative for the Development of Sagamu Community (RIDSCO) building (Figure 6) is a simple structure modelled after a school classroom block. According to Omoba Abiola Ogundeko and Mr Lukman Banjoko, the RIDSCO building is the only structure among the old Akarigbo palace structures that was not touched by the irate youth who burnt down the Old Palace. Mr. Lukman Banjoko maintains that RIDSCO was established in February 1998by the Late Akarigbo and Paramount Ruler of Remoland, His Royal Majesty, Alaiyeluwa Oba Dr. Michael Adeniyi Sonariwo, FCA, CON, KJV, Erinjugbo II, to harness the support of the then West African Portland Cement Company (WAPCO) for sustainable development projects for Sagamu Local Government Area.

Figure 5:
The Generator house at Akarigbo's Place
Source: Samson Kehinde Adekoya, (2022)

Figure 6:
The Royal Initiative for the Development of Sagamu Community (RIDSCO)
Source: Samson Kehinde Adekoya, (2022)

The Main Office Building/Administrative or Office Complex

The Main Office Building/Administrative Office Complex (Figures 7 and 8) is situated on the same row as the RIDSCO building, forming a large courtyard at its rear. One of the entrances to the courtyard is created with a round Iron pipe under the Porch (Figure 9) of the Main Office Building/Administrative or Office Complex. The office complex is a two-storey building constructed in two rows, with a small courtyard situated between them. The total imagery of the structure could be likened to the capital letter "H" in the alphabet. The ground floor of the left-hand row contains the Secretary's Office, the Chief of Staff's Office (CoS), the Personal Assistant to the *Akarigbo's* (PA) Office, and the *Akarigbo's* Office. There is a passage that links the Secretary's Office with that of the *Akarigbo.* The ground floor of the right-hand side row is a big hall where the *Akarigbo*-in-Council hall (Figures 11 and 12) is located. There is a Staircase (Figure 13) that links the ground floor with the upper floor.

Figure 7:
The Front view of the *Akarigbo* Palace Main Office Building/Administrative or Office Complex
Source: Samson Kehinde Adekoya, (2022)

Figure 8:
The Right side view of the *Akarigbo* Palace Office Building/Administrative or Office,
Source: Samson Kehinde Adekoya, (2022)

Figure 9:
The entrance to the Courtyard behind the Main Entrance to the Office Complex
Source: Samson Kehinde Adekoya, (2022)

Figure 10:
Secretary/Administrative Office
Source: Samson Kehinde Adekoya, (2022)

***Akarigbo*-in-Council Hall**

Akarigbo-in-Council Hall is a large hall on the ground floor of the right-hand side row. The hall is where the chiefs meet regularly to deliberate or discuss issues relating to the growth, Development and peaceful coexistence of all the various groups of people living in the town. It also doubles as the courtroom where conflicts are settled among the warring members of the community. According to Chief Abdulrasak Adeyemi Salami, the *Lisa Akarigbo* of Remoland, three people control the affairs of Ofin: the *Akarigbo*, ably assisted by the *Lisa* as the second-in-command, and the *Losi.*

Figure 11:
The *Akarigbo's* Throne in the *Akarigbo*-in- Council Hall
Source: Samson Kehinde Adekoya, (2022)

Figure 12:
The *Akarigbo*-in-Council Hall
Source: Samson Kehinde Adekoya, (2022)

The Remo Royal Council of *Obas* Hall

The Remo Royal Council of *Oba's* hall (Figure 14) is a large hall located on the upper floor of the first row on top of the Secretary/*Oba's* main Office. The hall is where all thirty-three conventional rulers of the cities that make up Remoland meet periodically to discuss and deliberate on issues related to the Development of their multiple towns, cities, and the entire Remoland at large. The seats are arranged in a boardroom arrangement.

Figure 13:
The Staircase that leads to the Upper floor of the *Akarigbo* Palace Main Office Building/Administrative or Office Complex
Source: Samson Kehinde Adekoya, (2022)

Figure 14:
The Remo Royal Council of *Obas* hall
Source: Samson Kehinde Adekoya, (2022)

The Museum/Library

The Museum/Library is a moderate-sized hall on the upper floor opposite the Remo Council of *Obas* Hall. The hall is divided into two sections: the Museum section (Figure 15) and the Library section (Figure 16). The Museum and Library sections were newly created after the transition of *Akarigbo*, *Oba* Michael Adeniyi Sonariwo, *and Erinjugbo* II, following the destruction of the former Palace by irate youth in 2003. Thus, the Museum only contains pictures, paintings, and items such as Staff of Office, Seat (throne), horsetail, and walking stick used by the immediate past *Akarigbo Oba* Michael Adeniyi Sonariwo, *Erinjugbo* II and the books in the Library section are also the materials acquired during and after the reign of Oba Michael Adeniyi Sonariwo, Erinjugbo II, and those probably published or acquired during the incumbent *Akarigbo* reign.

Figure 15:
A section of the Museum inside Akarigbo Palace
Source: Samson Kehinde. Adekoya (2022)

Figure 16:
The Library section inside the Museum
Source: Omoba Abiola Ogundeko (2021)

The *Oba's* primary residence

The *Oba's* primary residence is demarcated from the Administrative apartment with a fence of about 6ft high, painted with dark grey, as shown in Figure 17. There is a gangway (Figure 18) that links the administrative building with the *Oba's* primary residence. The *Akarigbo* main residence is a massive compound-like structure comprising four two-storey buildings, each linked together by a common courtyard (see Figures 19, 20, 21, and 22). The structure, according to *Omoba* Biola Ogundeko, houses the *Oba* and his immediate family's apartment, the Banquette Hall, the Presidential Lodge, and the V.I.P. Lodge. The structure and administrative office complex, as well as the *Akarigbo's* Palace Hall, are characterised by an arch, a feature common to ancient traditional Yoruba palaces. In front of the *Oba* and his immediate family's primary residence is a large Porch, as shown in (Figures 19 and 20). The researcher did not have access to the structure to ascertain its components, except for the exterior. The windows are made of cream-coloured aluminium frames and tinted glass, while the doors are made of iron and painted a grey colour. The entire building is painted in two colours: cream and grey. *Omoba* Biola Ogundeko maintains that the Banquette Hall is used to host very important Guests and dignitaries, such as the President, Governors, ministers, and other highly placed Government functionaries, for dinners, awards, and the conferment of chieftaincy titles. He also notes that the V.I.P. Lodge provides accommodations for the aforementioned guests and dignitaries. Other structures in the premises of the *Akarigbo's* principal residence are the Security post (Figure 23) and the *Akarigbo's* Entourage Quarters (Figure 24). Both are painted with a dark grey colour.

Figure 17:
The *Oba's* primary residence is separated by a fence from the Administrative apartment
Source: Samson Kehinde Adekoya, (2022)

Figure 18:
The gangway that links the administrative Office with the *Oba's* residence
Source: Samson Kehinde Adekoya, (2022)

Figure 19:
The front view of the *Oba's* residence
Source: Samson Kehinde Adekoya, (2022)

Figure 20:
The *Akarigbo* primary residence
Source: Samson Kehinde Adekoya, (2022)

Figure 21:
The Left side view of the *Akarigbo* Main Residence
Source: Samson Kehinde Adekoya, (2022)

Figure 22:
The Back view of the *Akarigbo* Main Residence
Source: Samson Kehinde Adekoya, (2022)

Figure 23:
The *Akarigbo's* Entourage Staff Quarters,
Source: Samson Kehinde Adekoya, (2022)

Figure 24:
The Security Post at the *Akarigbo's* Main Residence
Source: Samson Kehinde Adekoya, (2022)

The Car Park at the *Akarigbo* Main Residence

Observably, the Car Park (Figure 25) is a small, open, and makeshift structure that accommodates only two cars at a time. It is constructed with a galvanized round pipe and a synthetic canopy. It is located very close to the Akarigbo and family apartment.

The Lawn Tennis Court and Table Tennis at the *Akarigbo* Palace

Among the structures in *Akarigbo's* Palace is a standard Lawn Tennis Court enclosed with wire gauze (Figure 26). It has a gallery where spectators can sit to watch the game. There is also a table tennis table arranged in the lobby under the two-storey building beside the *Akarigbo* and his family's apartment.

Figure 25:
The Car Park at the *Akarigbo* Main Residence
Source: Samson Kehinde Adekoya, (2022)

Figure 26:
The Lawn Tennis Court at the *Akarigbo's* Palace
Source: Samson Kehinde Adekoya, (2022)

Akarigbo's **Palace Hall**

One of the striking features of the *Akarigbo's* Palace architectural design is the one thousand (1000) sitters' capacity of the Akarigbo's Palace Hall (Figure 27), located beside the Ogun State Council of *Baales* Building (Figure 28). It is one of the structures characterised by an arch among the structural components of the Palace. It is a vast structure painted in dark grey and cream colours. The windows are made with cream colour aluminium frames and tinted glass. According to Mr Bosun Soneye, the hall can accommodate one thousand guests at a time. The Ogun State Council of *Baales'* Building is a two-storey building where the *Baales* of various communities meet regularly to discuss the growth and development of their respective communities.

Figure 27:
The Right view of the 1000 sitters *Akarigbo's* Palace Hall
Source: Samson Kehinde Adekoya, (2022)

Figure 28:
The Ogun State Council of *Baales* Building at *Akarigbo* Palace
Source: Samson Kehinde Adekoya, (2022)

Figure 29:
The Open Courtyard in front of the Administrative Building, the spot where the Old Palace was demolished,
Source: Samson Kehinde Adekoya (2022).

Figure 30:
The Open Courtyard in front of the Administrative Building when in use,
Source: Samson Kehinde Adekoya (2022)

The Bust of the *Akarigbo Oba* Victor Babatunde Ajayi and the Cenotaph

The Bust of the *Akarigbo, Oba* Victor Babatunde Ajayi (Figure 31) and the Cenotaph (Figure 32) are erected in the open courtyard on the right-hand side immediately after one enters the palace ground.

Figure 31:
The Bust of the *Akarigbo* at the back of the Cenotaph
Source: Samson Kehinde Adekoya, (2022)

Figure 32:
The Cenotaph at the *Akarigbo's* Palace
Source: Samson Kehinde Adekoya, (2022)

Significance of the Palace to the people of Remoland

Chief Abdulrasak Adeyemi Salami, the *Lisa Akarigbo* of Remoland, maintained that the Palace plays a very significant role in the lives of the people of Sagamu and the entire Remoland at large. The Palace provides a venue for the thirty-three Remo traditional *Obas* to meet regularly and discuss the Development and growth of the various communities that make up Remoland. The Palace also hosts

various cultural activities and events, such as the conferment of chieftaincy titles and other traditional festivals, including the Egungun festival, name a few.

Conclusion

The paper has examined, documented, and analysed all the existing structural components, both old and new, in the premises of the *Akarigbo* Palace in Sagamu, Ogun State, Southwest Nigeria. The paper found that all the structures are newly built with modern materials and technology, except for the RIDSCO building (Figure 6) and the Cenotaph (Figure 32), which are part of the Palace's older structures. From oral accounts, the paper also discovered that none of the old structures were storey buildings, unlike the new *Akarigbo's* palace Administrative building (Figures 7, 8, and 9) and the primary residence (Figures 19, 20, 21, and 22). The inclusion of modern sporting facilities, security post, entourage staff quarters and multipurpose hall is all modern or contemporary conceptions that added value and beauty to the newly built *Akarigbo's* palace architecture that made it align with the Yoruba parlance that says, "*Ile Oba to jo, Ewa lo bu si"*.

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FABRIC APPROPRIATION IN SCULPTURES: AN ENQUIRY INTO MEDIA AUTONOMY

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Abstract
Creative media, such as fabrics, bring with them some natural properties that are specific to the artist, serving as clues to their workability and behaviour. What happens when these materials are disentangled from the shackles of their stereotypical endowments? What meanings are lost or perhaps what meanings emerge, when they are displaced from their hackneyed habitats? Or does newness arise from recontextualization even when the "new" carries with it "old" properties? This study, through participant observation and content analysis, explores the overlapping tendencies of representation and reality by re-interrogating the certainty about the autonomy of the medium in terms of its properties and meanings. It examines the shifting, amplifying, or losing of meanings by this medium when used or removed from its conventional habitat. Instead of being limited to the meaning the medium is already charged with, the implanting, recharging, and supplanting of these meanings to filter in new ones are one of the objectives of this study. Primarily, the essence of attempt to extend the frontiers of creative media. Redefinition is the crux of this study. By infusing new properties into the existing properties of the media, traditional laws of materials are broken, and horizons are opened for further breaking and making of new rules, thus contributing to the inexhaustibility of creative ideals.

Keywords: Appropriation, Sculpture, Creative Media, Fabric, Ideation And Process

Introduction

The production of fabric is a craft whose origin is likely the same as that of man. Man's need for warmth, protection and privacy might be instrumental to his craving for clothing or its equivalent. Whether it was a cluster of leaves around the groin and breast or the manual extraction of more durable fibres from plants and animals to protect or cover himself, the origin of fabric or clothing dates back to the earliest humans. However, fabric production has been altered by industrialisation and the introduction of modern manufacturing techniques. Fabrics exist in assorted forms, the most common of which is in clothing. It is equally used to make containers such as bags and baskets. In the household, it is used in carpeting, upholstered furnishings, window shades, towels, and so on. It is conventionally used as a strengthening material in fibreglass. Here, the technically woven interplay of strings is softened or melted together by a combination of chemicals, such as resin, catalyst, and accelerator. The boundary of fibre has encroached into unsuspected quarters. Materials such as foil made from micro strings of metal possess similar endowments to traditional fibres. Micro strings of metal possess identical endowments to conventional fibres. Foil made from micro strings of metal, like conventional fibres, also possesses similar endowments. Foil made from micro strings of metal, like conventional fibres, also has identical endowments. This would be demonstrated under the heading "Ideation and Processes."

On the other hand, appropriation of visual culture and art has always been part of human history. Art History and art historical practice have a long tradition of borrowing and previously practised. Artists have always learned and progressed by copying and borrowing from one another. One is tempted to say that the act of making art began with appropriation; borrowing images, sounds, concepts from the surrounding world and incorporating them into art. Appropriation can be seen as in which art has progressed through borrowing.

Some might interpret Leonardo Da Vinci as an appropriation artist. Da Vinci used recombinant methods of appropriation, borrowing from sources as diverse as biology, mathematics, engineering and art, and then synthesising them into inventions and works of art. "His knowledge of anatomy was unsurpassed… and his interest in natural worlds of geology and botany was keen Cunningham & Reich (2006:19)

In the early twentieth century, Pablo Picasso and Georges Braque appropriated objects into their works. Picasso pasted pieces of cloth on the canvas. Afterwards, compositions Guitar," "Newspaper," "Glass and Bottle", in which Picasso used newspaper clippings to create forms, joined the Cubist category.

Marcel Duchamp also went as far as using existing art in his work, appropriating an apparent copy of the Mona Lisa into his piece.

Other Dada exponents, along with Duchamp, continued with the appropriation of everyday objects, a response to the oppressive intellectual rigidity in both art and everyday society.

After the Dada movement, the Surrealists also incorporated "found Objects" into their works. These objects took on new meanings when combined with other unlikely objects.
Jasper Johns incorporated found objects into his work in the 1950s. Johns also appropriated symbolic images such as the American Flag into his work. Andy Warhol and other pop artists appropriated images from commercial art and popular culture as well as the techniques of these in their works. (Appropriation Art,2009). They saw popular culture as the main vernacular for making artistic statements. Meanwhile several other instances abound as testimonies to appropriation in every art movement, and artists working today increasingly incorporate known elements into their works.
"Some media lend themselves more naturally than others to the development of a full range of value", Cayton (2009:153). But what new meanings are unlocked if such media are appropriated or divorced from their natural contexts? Are there continuations, modifications delusions of original legacies left

by these materials, and eventual delusions of original legacies left by these materials, and eventual delusions of original legacies left by these materials, and eventual delusions of original legacies left by these materials in their newly generated state?

Why Fabric?

The nature and properties of fabric pose an interesting challenge that inspired the interest in this study. The draperies and flows are imbued with such elegance and drama that they keep the mind dancing. Since fabrics exist in varying forms and characteristics, some to negate most of the usual assumptions about what should be considered fabric. It is a likely perception that what is be soft, smooth, and easy to work with. rugged Evidence abounds that shows some forms of fabric are sturdy and rugged in terms of behaviour. Between the obedient and the recalcitrant, one sees a variety of messages occasioned by the inexhaustibility of fibre language. For instance, which is common in the culinary world, could be pregnant with meanings. Although a metal fabric categorised as Lurax, it could also relate to cookery and dishing, as well as death and burial. Since foil is predominantly used in wrapping edibles, if man is wrapped in the same way, it could be an exploration of the interplay of death and birth, since the eater is also edible. Foil is the package for food before eating, while the coffin is man's package for the termites' verdict. Anyway, we are but potential meals on the dining table of time. Survey the metaphors/iconography in the following plate:

Fig. 1.1, Artist: Erasmus Onyishi, Year: 2011
Title: FOOD IS READY (Performance/ Installation)
Media: REPURPOSED FOIL, JUNKS AND HUMANS
Photo: The Artist

Interpretation

IF:
Stillbirth is FFF(FRESH FROM FARM),
The infant is PARBOILED,
The child is STEAMED,
The Youth is HALF-DONE,
The adult is BAKED,
The aged is FRIED,
The sick is ROASTED,
The healthy is FRUIT,
The casualty is CHOPPED,
The young is HOT,

The old is COLD,
Sickness is APPETIZER,
Tears are DESERT,
FOOD is LIFE,
FOOD is DEATH,
DEATH is FOOD,
Make-up is GARNISHING and
The EATER is EDIBLE,
Then,
FOOD is Ready.
(We are but potential meals on the dining table of time)

The foregoing example belies the essence of this study. That is, it does not dwell only on the visual representations but more on the philosophical implications of the viewed. For draperies could be likened to wrinkles as a metaphor for old age or ageing. "Art media, in recent times, have been radicalized to the extent that the artist rose from using non-conventional materials to being the material itself in artistic renditions" Onyishi E.O., 2023:34). There tends to be in recent times some blurring margins among conventionally distinct art professions (Onyishi E.O, Agbor NJ & Ochini EO 2024:1). The foregoing performance fuses visual and Theatre Arts.

Ideation And Processes

Fig. 1.2
Masking of persons for the "FOOD IS READY" performance

The process of generating, developing, and transforming new ideas or turning fluid thoughts into a tangible form is termed ideation. Ideas are the basic elements of thought that can be either visual, concrete, or abstract. Ideation is all stages of the thought process, from brainstorming to the development of thoughts. It is a crucial part of the creative process. Herein, ideas are propelled by the urge to reposition the thought process by placing familiar media in unfamiliar contexts. The image above reflects such media re-positioning.

The masking process with Lurax fibre (aluminum foil) involved several studio hands. Four people of similar heights were masqueraded as undertakers for the performance. Foil is a peculiar culinary medium used in wrapping edibles. The sight of it evokes the desire for or the idea of food. In this performance, the foil is a metaphor for food. Wrapping a man in foil makes the audience think of the man as edible. The eater is also edible. We are but potential meals. The casket masked with foil and filled with forms of drinks and sundry edibles gives the impression that man, tolling the biblical line,

who ate himself out of paradise, dies eating himself back to it. Inasmuch as we live to eat, we are killed by what we eat. In such a similar fate with the consumables as we are as well consumed by termites and flame (in the case of cremation) at death.

In another studio experiment, One explored the recontextualization of fabric. Here, strings of cloth are made from wider wrappers.

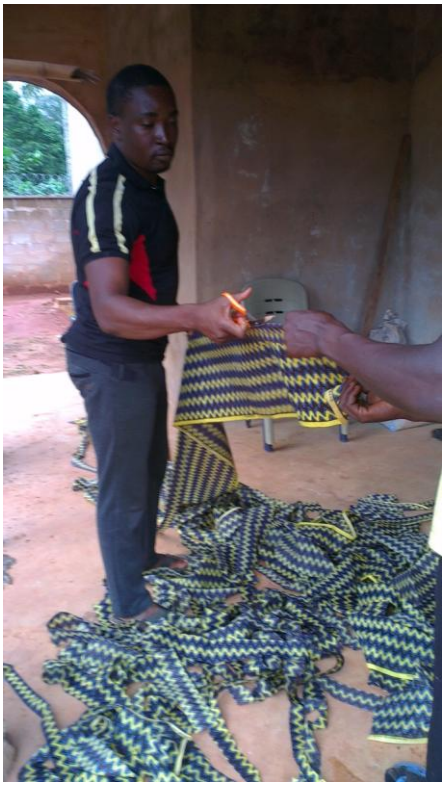


Fig 1.3
Slicing the wrappers
Photo: Candidus Onyishi

Fig 1.4
Masking Of The Branches
Photo: The Artist

Even the thin branches are painstakingly masked to seal the pores of the wood. Here, the inanimate is animate brought to life. The cloth assumes life as it follows the sprouting pattern of the branches, thereby creating a visual illusion of a natural, beautiful bark. Fibreglass is also used to generate sphere impressions as a visual allusion to heavenly bodies. The bi-coloured cloth

Fig 1.5 (The Finished Work), **VIRUS,** ERASMUS ONYISHI
7X19X28 FEET, 2013, WOOD AND FABRIC
Photo: the artist

Interpretation

Orderliness is an occasional episode in the general drama of chaos. The threat symbolised by the wood in its centrifugalism holds our worlds in balance, symbolised by the wood in its centrifugalism. The killer is as beautiful as the fabric that seals the pores of the branches, but its beauty camouflages its malevolence. Thus, it is a critique of our polity.

In another exploration of appropriated forms, an artist wrapped a bike with a conventional palm wine taper's apparatus in an effort to re-examine the nature of leadership in Nigeria.

Fig 1.6, ERASMUS ONYISHI, **WHERE IS THE RIDER?,** FABRIC AND PLASTIC ON BICYCLE
PHOTO: THE ARTIST

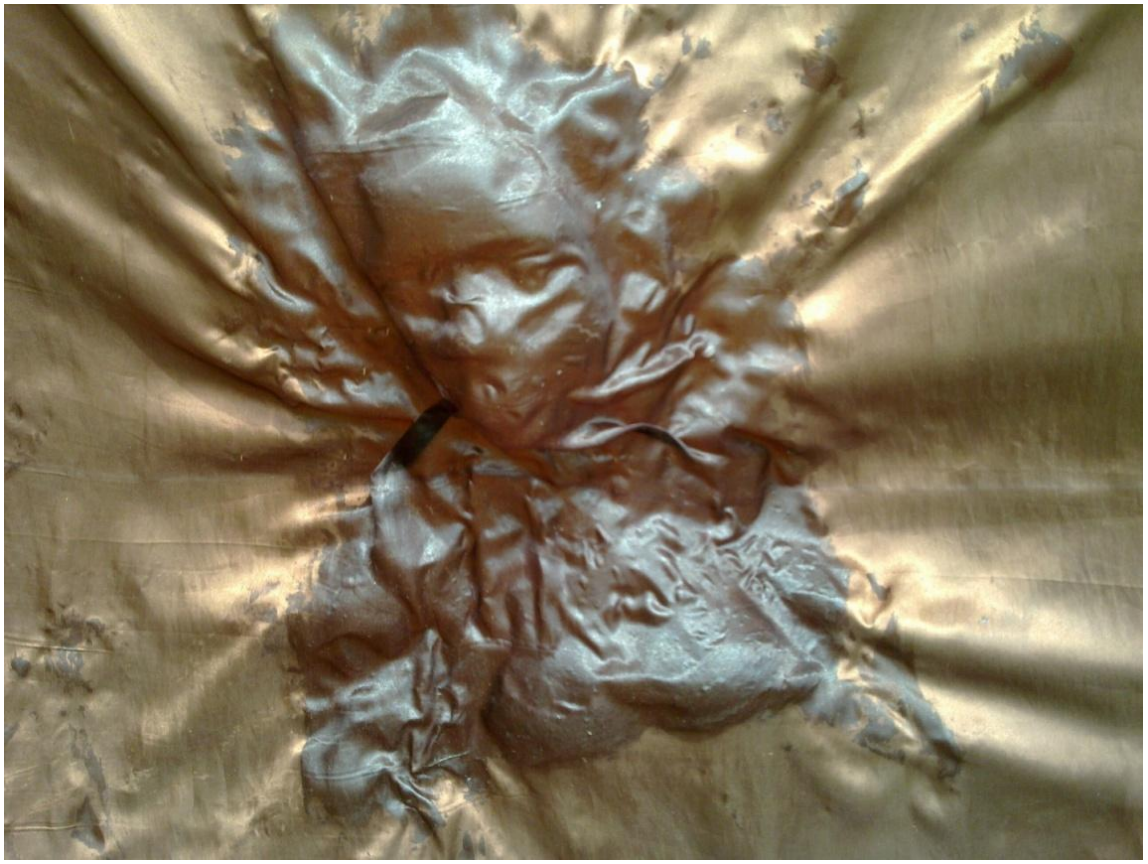
Here all the requirements for a palm wine hunt are ready, but where is the rider? The installation implies that amidst the rich natural cum human resources, the Nigerian nation still wallows on the slippery terrain of bad leadership. The beautiful outlay with its interesting and inviting colours, is my sculptural allusion to the competencies herein, left to the squandering mercy of greedy men.

The bicycle could be a metaphor for the itinerancy of most aboriginal African peoples. Constantly, they moved in search of succor. Another aspect of this is the nonchalance or indifference in terms of followership. As Willet (2002:16) puts it:
Many people of Africa lead a pastoral existence, herding cattle, sheep, and goats. They too lead a largely migratory life, seeking fresh pastures or water for themselves and their herds.

In another work, I explored the flamboyance of the umbrellas and likened them to the African mushrooms. This addresses tolerance and coexistence as spices of enduring progress. As Achebe (1998) reiterates, "artists should not stop at documenting social-cultural or religio-economic problems but also embark on a higher responsibility of proffering prescriptions." The mushroom series is a visual whisper into the soul of the ailing nation. It further lends credence to Oloidi's proposition that: "an artist is a surgeon who cuts through the flesh of a sick society using sympathetic instruments, thereby correcting those ills that are repugnant to human existence" (1997)

Fig. 1.7, Erasmus Onyishi, **Mushroom,** 2013
Umbrellas And Fabric, Photo: The Artist

Interpretation
"There is conscious effort on the part of the artist to have his actions culminate in beauty. Onyishi E.O. and Onyishi UC (2025:70). The beauty of life lies in peaceful co-existence. Each has its nature-endowed territory where it flourishes within its potential. Modelling and casting with fabric pose some spontaneity that is worth discussing. Below is an experiment in fabric casting.



Erasmus Onyishi, **You Can Shut Her Mouth, but not Her Eyes,** *2010*
4X4.3 feet, Fabric and Stiffener, Photo: The artist

In the above example, a portrait of a lady was made with clay. Afterwards, a two-piece mould was produced in concrete. Vaseline was used both to allow easy pulling and to maintain the clean nature of the nylon. Instead of charging with fibre glass or other traditional media, a piece of nylon was spread into the mould, and fabric stiffener was applied with a bristle brush to allow the fabric to reach the contours of the mould. After being exposed to the sun, the fabric was pulled out. Due to the lightweight nature of nylon, lacking a strengthening core, some surface areas were damaged, resulting in an unintended design. There was a concentration of the stiffener around the left eye, allowing it to appear defined, whereas the mouth and the burst lost their definition, allowing them to appear less defined. In contrast, the mouth and the burst lost their definition. This piece was almost discarded as a failed, but on second thought, it reflects vividly the position of female folk in a patriarchal world. The undefined breasts and battered body could be visual allusions to genital mutilation, rape, sex-slavery, abduction and child labour. Their level of female participation in national discourse is represented here with a sealed mouth, indicating marginalisation in national discourse, which is also reflected in the sealed mouth, representing the marginalisation of freedom of speech. However, no matter how badly mutilated the female social portrait is, their eyes see.

Summary

The fabric whose origin was geared towards covering nakedness uncovers nakedness in the foregoing arguments. Thus, the recontextualization has brought about revelation through concealment. For instance, the covering of branches and sundry junk exposes the deficiencies of governance. These works often take the cue from incongruous elements, ideas and ideals. They are both personal and affective, and the artist is notably not in control of the outcome. The artist seeks an autonomy of media that does not conform and operates through absurdity. Thus:

> Art is designed to be arresting, to engage our attention, to make us look and to be aware of our act of looking, and potentially to be enriched as a result. That gift of engaged vision, in contrast to our everyday inattentiveness, is one of the greatest, most excellent, and most significant benefits of art (Lazarri & Schlesier, 2008:8)

The new vistas evoke in us the same sensibilities that installations like these inspire. They reactivate our consciousness and channel our common notions to unexpected quarters. They achieve this by lifting familiar phenomena and fusing new ideals into them.
The controversy "appropriation" primarily hinges on issues of originality and authorship. Another problem is whether fabrics regarded as popular culture should be treated as works of art or as independent design units, therefore justifying the use of the term 'appropriation' in this context. Popular culture "consists of magazines, comics, television, tourist art, advertising, folk art, tattoos, customised cars, graffiti, video games, posters, websites, calendars, greeting cards, dolls, toys, etc." Lazzari & Schlesier (2008:12). Folk art and tourist art encompass fabrics. The question is should they be called art or craft? But are they not infused with 'style' which Aniakor posits is "clue to authorship"?

Trained and untrained artists live, and many of them share the same collective experiences. The linkages of history and social differentiation form the warp and weft of a single fabric (Littlefield, 1999:48).

So, until the persona of the art maker is defined, it would to demarcate what constitutes art and what does not. Like Onyishi E.O. &, Onyishi U.C.E.O., Onyishi U.C.E.O. & Onyishi U.C.E.O. &, & Onyishi U.C. (2018:87) query "Who is an artist in the face of this eclectic milieu and what makes him one?" Therefore, if art can be conceived as an open-ended discipline with limitless options, this study would extend the frontiers of the visual vocabulary. Again, no ideology is definite. An end opens a beginning, and a beginning could be an end.

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