THE PROSPECT OF SMART BUILDING DEVELOPMENT IN BENIN CITY.

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THE PROSPECT OF SMART BUILDING DEVELOPMENT IN NIGERIA, USING BENIN CITY AS A CASE STUDY

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A PROJECT SUBMITTED TO THE DEPARTMENT OF ESTATE MANAGEMENT, FACULTY OF ENVIRONMENTAL SCIENCES, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.SC.) DEGREE IN ESTATE MANAGEMENT

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DECLARATION

I, **IJEH AMARACHI JOY**, declare that this project is entirely my own work and composition.

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CERTIFICATION

We, certify that the project titled: **THE PROSPECT OF SMART BUILDING DEVELOPMENT IN NIGERIA USING BENIN CITY AS A CASE STUDY** was carried out by **IJEH AMARACHI JOY**, **ENV1905946.** We, therefore, certify that the work is adequate in scope and quality in partial fulfilment of the requirements for the award of Bachelor of Science (B.Sc.) degree in the Department of Estate Management, Faculty of Environmental Sciences, University of Benin, Benin City, Edo State, Nigeria.

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DEDICATION

I dedicate this work to God Almighty, for his guidance and protection throughout my academic journey, may his name be praised and to my family for their unwavering support and making this a reality.

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TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

The rapid advancement of smart technologies has significantly influenced various sectors, particularly in urban development and infrastructure management. This study explores the 'prospect of smart building development in Nigeria, using Benin City as a case study'. The increasing rate of urbanization in Nigeria, projected to reach 70% by 2050, necessitates the adoption of innovative solutions to tackle infrastructural challenges and enhance the quality of life for citizens. Smart buildings, which integrate advanced technologies such as the Internet of Things (IoT), automation systems, and energy-efficient solutions, present a viable opportunity to improve resource management, energy efficiency, and sustainability in urban environments.

The study aims to assess the current state of building infrastructure in Benin City, identify the potential benefits of smart buildings, and evaluate the challenges hindering their widespread adoption. The research adopted a survey research design, employing both primary and secondary data collection methods. Primary data was gathered through structured questionnaires administered to Estate Surveyors, Engineers, Architects, and Quantity Surveyors in Benin City, with a total of 205 valid responses analyzed using descriptive statistical methods, The findings revealed that while there is growing awareness of smart building technologies, several barriers persist, including high initial capital costs, limited awareness among stakeholders, inadequate regulatory frameworks, and infrastructural deficiencies such as poor internet connectivity and unstable electricity supply.

The study highlights the numerous benefits of smart buildings, including enhanced security systems, energy efficiency, improved indoor air quality, and optimized resource management. However, it also underscores the need for government intervention through supportive policies, public awareness campaigns, and financial incentives to encourage the widespread d adoption of smart building technologies. The research concludes that while the adoption of smart buildings in Nigeria is still at a nascent stage, strategic collaborations between the government, private sector, and educational institutions could pave the way for a more sustainable and technologically advanced urban environment.

This study serves as a valuable resource for policymakers, urban planners, developers, and academics, providing insights into the prospects of smart building technologies and offering recommendations to foster their growth in Nigeria's built environment.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The global shift towards smart technologies has transformed various sectors, including urban development, energy management, and infrastructure. Smart buildings integrated structures that utilize advanced technologies for efficiency and sustainability, have emerged as a vital component of this transformation. In Nigeria, a country characterized by rapid urbanization, population growth, and infrastructural challenges, the prospect of developing smart buildings presents a unique opportunity to address these issues while enhancing the quality of life for its citizens (Umeh & Okekem 2023). The rapid pace of urbanization in Nigeria, projected to reach approximately 70% by 2050, presents both challenges and opportunities for the nation's infrastructure development. With over 200 million inhabitants, Nigeria is experiencing significant pressure on its existing urban systems, leading to issues such as inadequate housing, energy shortages, traffic congestion, and environmental degradation. These challenges are exacerbated by a growing population and increasing economic activities that demand innovative solutions to improve the quality of urban life (Orji & Ugwu, 2022).

Smart buildings are advanced structures that leverage technology to enhance operational efficiency, occupant comfort, and sustainability. By integrating systems such as heating, ventilation, air conditioning (HVAC), lighting, security, and energy management through the Internet of Things (IoT), these buildings can optimize energy consumption and reduce operational costs. Smart buildings often feature automated controls that respond to real-time data, allowing for more efficient use of resources while improving the overall user experience (Adewale, 2023). In the context of Nigeria, where urbanization is rapidly increasing and infrastructural challenges are prevalent, the adoption of smart building

technologies presents a significant opportunity to create more resilient, sustainable urban environments that can meet the demands of a growing population. Smart buildings characterized by energy-efficient systems, automated controls, and enhanced connectivity, can serve as a catalyst for modernization in Nigeria's real estate and construction sectors (Bakare, 2023).

However, Smart building development involves the integration of cutting-edge technologies and sustainable practices into the design, construction, and operation of buildings. This process encompasses the utilization of sensors, automation, and data analytics to create environments that are energy-efficient, adaptable, and responsive to the needs of occupants. By implementing systems that optimize energy usage, enhance security, and improve indoor air quality, smart buildings can significantly reduce operational costs and environmental impact (Umeh & Okekem 2023). Furthermore, smart building development promotes the use of renewable energy sources and advanced materials, fostering sustainability and resilience. As urban centers continue to grow, the development of smart buildings is increasingly viewed as essential for addressing the challenges of climate change, resource scarcity, and urban infrastructure demands, particularly in rapidly urbanizing regions like Nigeria. In recent years, the concept of smart buildings has gained traction globally as part of the broader trend toward smart cities (Adewale, 2023). Smart buildings utilize advanced technologies, such as the Internet of Things (IoT), artificial intelligence (AI), and automation, to enhance operational efficiency, reduce energy consumption, and improve occupant comfort. These buildings integrate various systems such as lighting, heating, ventilation, security, and energy management into a cohesive framework that responds dynamically to the needs of its users. The implementation of smart building technologies not only addresses immediate infrastructure

challenges but also promotes sustainability by minimizing environmental impacts and resource consumption (Adebayo, 2023).

Nigeria's current building infrastructure largely consists of traditional, less efficient structures that do not leverage modern technologies. This presents a critical gap that smart building development can fill. By embracing smart technologies, Nigeria can enhance its urban environments, reduce operational costs, and improve overall resilience against challenges such as climate change and energy crises (Ibrahim¸ 2023). Furthermore, the shift towards smart buildings aligns with global sustainability goals, including the United Nations' Sustainable Development Goals (SDGs), particularly Goal 11, which advocates for sustainable cities and communities. However, despite the promising prospects, several barriers hinder the widespread adoption of smart building technologies in Nigeria. These include limited awareness and understanding of smart building concepts among stakeholders, high initial capital investment requirements, inadequate regulatory frameworks, unreliable energy supply, and a lack of skilled personnel to implement and maintain these advanced systems. Additionally, the varying economic conditions across different regions of Nigeria can affect the feasibility and scalability of smart building initiatives (Adebayo, 2023).

This study aims to explore the prospects of smart building development in Nigeria by examining the current state of the built environment, identifying barriers to implementation, and proposing strategic pathways to facilitate the adoption of smart technologies. By analyzing successful case studies from other developing economies, this research seeks to provide valuable insights and recommendations that can help Nigeria harness the potential of smart buildings to address its urban challenges and contribute to sustainable development.

1.2 Problem Statement

The prospect of smart building development in Nigeria is hindered by a complex interplay of challenges that limit the widespread adoption and implementation of advanced technologies in the construction and real estate sectors (Umeh & Okekem 2023). Despite the undeniable benefits of smart buildings, such as energy efficiency, improved occupant comfort, and enhanced sustainability, the development process faces significant obstacles that need to be addressed. Firstly, there is a general lack of awareness and understanding of smart building technologies among key stakeholders, including policymakers, developers, and consumers. This knowledge gap results in skepticism regarding the effectiveness and feasibility of implementing smart solutions within the Nigerian context. Secondly, high initial costs associated with smart building technologies pose a significant barrier to entry for many developers and investors. The perception that these technologies are only feasible for high-end projects can lead to underinvestment in smart solutions for broader, more affordable housing developments.

Also, according to Owolabi and Ojo (2022), inadequate regulatory frameworks and policy support further complicate the landscape for smart building development. Without clear guidelines and incentives, stakeholders may be reluctant to adopt innovative practices that could drive sustainable urban growth. Additionally, the scarcity of skilled labor and expertise in smart technologies presents another challenge. The construction workforce in Nigeria often lacks the necessary training to implement and maintain smart systems, limiting the potential for successful integration. Infrastructural deficiencies, such as unreliable electricity supply and poor internet connectivity, impede the performance of smart buildings, undermining their potential benefits and discouraging investment in such projects. Given these challenges, it is crucial to explore the prospects of smart building development in Nigeria through comprehensive research that identifies barriers, assesses

the potential benefits, and proposes actionable strategies to foster the growth of smart technologies in the country's built environment. This study aims to fill the gap in understanding the interplay between these factors, thereby providing insights that can drive effective policy and practical solutions for the sustainable development of smart buildings in Nigeria.

1.3 Research Questions

This study seeks to answer the following research questions:

1. What is the current state of building infrastructure in Benin City?
2. What are the benefits of smart buildings in Benin City?
3. What are the challenges that hinder the adoption of smart building technologies in Benin City?

1.4 Aim and Objectives of the Study

The aim of this study is to examine the prospect of smart building development in Nigeria, using Benin City as a case study in a view to assessing the current state of smart building infrastructure in Benin City. However, the specific objectives of this study are to:

i. Assess the current state of smart building infrastructure in Nigeria.
ii. Identify the benefits of smart buildings in the study area.(Benin city).
iii. Examine the challenges hindering the widespread adoption of smart building technologies in Nigeria

1.5 Significance of the Study

The findings of this study on the prospects of smart building development in Nigeria hold significance for various stakeholders, each of whom can benefit from the insights and recommendations presented. The key beneficiaries include:

Government and Policymakers**:** Understanding the potential of smart buildings can help policymakers create supportive regulations and incentives that promote the adoption of advanced technologies in construction. This study provides evidence-based insights that can guide policy formulation aimed at enhancing urban sustainability and improving infrastructure resilience.

Urban Planners and Architects**:** Urban planners and architects can leverage the findings to design and implement smart building concepts in their projects. The study highlights the benefits of integrating smart technologies, allowing these professionals to create more efficient, user-friendly, and environmentally sustainable urban spaces.

Construction Industry Stakeholders**:** Construction companies, real estate developers, and investors can gain valuable insights into the feasibility and economic advantages of investing in smart building technologies. The study offers guidance on overcoming barriers to adoption, which can help these stakeholders align their strategies with emerging market trends.

Academics and Researchers**:** The research contributes to the existing body of knowledge on smart building development, providing a foundation for further academic inquiry. Scholars in urban studies, environmental science, and engineering can build upon this study to explore specific aspects of smart technology implementation and its implications for sustainable development.

Community Members and Residents**:** For the general public, particularly urban residents, the development of smart buildings can lead to improved living conditions, reduced energy costs, and enhanced quality of life. This study can raise awareness among community members about the benefits of smart buildings, encouraging public discourse and advocacy for such initiatives.

Environmental Advocates: The findings will be of interest to environmental organizations and advocates focused on sustainable urban development. The study emphasizes how smart building technologies can reduce environmental impacts, contributing to efforts aimed at combating climate change and promoting sustainability.

1.6 Scope of the Study

This study focuses on the prospects of smart building development within urban areas in Nigeria. While it addresses various aspects of smart building technologies, including energy management, automation, and environmental sustainability, it does not delve deeply into specific technical implementations or case studies within rural settings. The research will primarily draw on qualitative data from interviews with industry experts, policymakers, and stakeholders, as well as a review of existing literature on smart building practices globally and in similar economies.

1.7 Study Area

Nigeria lies in West Africa and is the biggest and most populous country on the continent, sharing borders with the Gulf of Guinea and situated between latitudes 4°201 and 14°301 east of Greenwich (Chukwuma, 2023). Edo State is situated in the southern region of Nigeria, around 40 miles from the Gulf of Guinea, with longitude coordinates of 6.6342°N and 5.9304°E. It shares boundaries with Kogi to the North, Delta to the South, and Ondo to the West.

According to Eze and Nwankwo (2023), Benin City is the biggest city in Edo state and southern Nigeria and is also the capital, as well as the fourth largest city in Nigeria, following Lagos, Kano, and Ibadan, with a population of 1,782,000 in 2021. It is located around 40 kilometers north of the Benin River and about 320 kilometers east of Lagos by road. Benin City is the hub of Nigeria's rubber sector, with oil production also playing a key role. Benin City comprises four local government areas: Oredo, Egor, Ikpoba Okha,

and Ovia North East. The state's administrative headquarters is situated in Oredo local government area, where the esteemed ancient throne of the Oba of Benin, Oba Eware Ogidigan II, is also found (Okafor & Agbo, 2023).

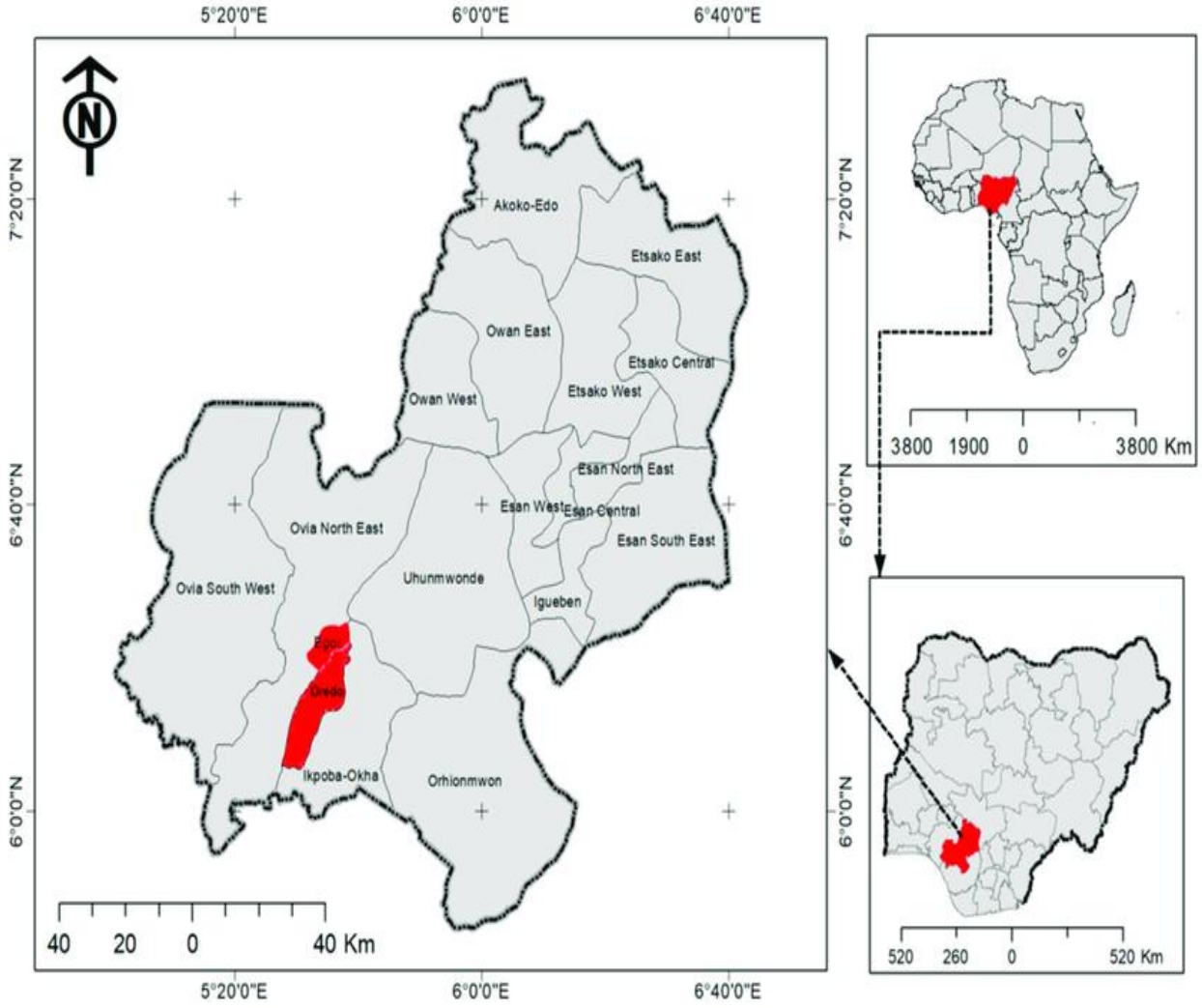

Fig 1: Map of Benin City. (**Source:** Chukwuma, 2023)

1.8 Definition of Terms

Smart Building: A smart building is a structure that uses advanced technologies, such as the Internet of Things (IoT), automation, and data analytics, to optimize operational efficiency, enhance occupant comfort, and improve energy management and sustainability.

Sustainability: Sustainability in the context of building development refers to the practice of creating structures that minimize environmental impact, use resources efficiently, and promote social and economic well-being for current and future generations.

Energy Efficiency: Energy efficiency is the goal of reducing energy consumption while maintaining the same level of comfort and service. In smart buildings, this is achieved through the use of energy-efficient systems and technologies that monitor and control energy use.

Internet of Things (IoT): The Internet of Things is a network of interconnected devices that communicate and exchange data over the internet. In smart buildings, IoT devices are used to monitor and control various building systems, such as lighting, heating, and security.

Automation: Automation refers to the use of technology to control processes and systems with minimal human intervention. In smart buildings, automation allows for real-time adjustments to environmental controls based on data collected from sensors.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section presents literatures that are relevant to the study. It will be presented under the following subheadings:

2.1 Conceptual Review

2.1.1 Smart Building

A smart building is an advanced structure that leverages cutting-edge technologies and systems to enhance its functionality, sustainability, and occupant experience. At its core, a smart building integrates various technologies such as the Internet of Things (IoT), automation, and artificial intelligence (AI) to monitor, control, and optimize building operations in real-time. This integration enables a seamless interaction between the building's systems, including lighting, heating, ventilation, air conditioning (HVAC), security, and energy management (Okwuashi & Chukwudi, 2023). By employing sensors and data analytics, smart buildings can gather and analyze information on usage patterns, environmental conditions, and energy consumption, allowing them to adapt dynamically to the needs of their occupants.

One of the primary objectives of smart buildings is to enhance energy efficiency. Traditional buildings often operate with fixed systems that do not respond to real-time conditions, leading to energy wastage and higher operational costs. In contrast, smart buildings utilize automated controls to adjust lighting and temperature based on occupancy levels or time of day, significantly reducing energy consumption. For instance, occupancy sensors can turn off lights in unoccupied rooms or adjust the HVAC system to maintain optimal temperatures only when needed (Eze & Nwankwo, 2023). This not only lowers utility bills for occupants but also contributes to a reduction in the overall carbon footprint

of the building, aligning with global sustainability goals. Umeh and Okeke (2023), smart buildings enhance occupant comfort and safety through improved air quality and security systems. Advanced ventilation and air filtration systems can monitor indoor air quality, adjusting airflow to ensure a healthy environment. Smart security systems employ surveillance cameras, motion detectors, and access controls that can be managed remotely, providing residents and building managers with peace of mind. These features are particularly important in urban areas, where safety concerns and environmental quality are critical for overall well-being (Okwuashi & Chukwudi, 2023).

In the context of Nigeria, the development of smart buildings holds significant promise. Rapid urbanization has led to increased demand for housing and commercial spaces, often outpacing the availability of essential services and infrastructure. Smart buildings can address these challenges by providing efficient, scalable, and sustainable solutions (Orji & Ugw, 2022). They offer an opportunity to modernize Nigeria's built environment, leveraging technology to create resilient urban spaces that can adapt to the needs of a growing population. Despite their advantages, the implementation of smart building technologies in Nigeria faces several challenges. These include high initial costs, limited public awareness, and a lack of skilled personnel trained in smart technologies (Eze & Nwankwo, 2023). Additionally, inadequate regulatory frameworks can hinder the adoption of innovative practices. Overcoming these barriers will require collaborative efforts among government, industry stakeholders, and educational institutions to promote knowledge sharing, provide financial incentives, and establish supportive policies. Smart buildings represent a transformative approach to modern architecture and urban development. By integrating technology to improve energy efficiency, occupant comfort, and overall sustainability, they have the potential to revolutionize the way we interact with our built environment. As Nigeria continues to navigate the complexities of urbanization, the

adoption of smart building practices could play a pivotal role in creating sustainable and livable cities for future generations (Umeh & Okeke, 2023).

2.1.2 Smart Building Development

Smart building development in Nigeria is an emerging concept that reflects the nation's response to rapid urbanization, infrastructural deficits, and the urgent need for sustainable practices in urban planning. As Nigeria's population continues to grow, with projections indicating that urban dwellers will account for over 70% of the population by 2050, the demand for housing, office space, and commercial facilities is at an all-time high (Orji & Ugw, 2022). This presents a unique opportunity for the integration of smart technologies into the construction and management of buildings, addressing both immediate needs and long-term sustainability goals. The primary objective of smart building development in Nigeria is to enhance energy efficiency and reduce operational costs. With the country grappling with an inconsistent power supply and high energy costs, adopting smart technologies can significantly optimize energy usage. For instance, building systems that utilize IoT devices can monitor energy consumption patterns and adjust settings in real-time, ensuring that resources are used efficiently (Yusuf & Adeyemi, 2022). Furthermore, the implementation of renewable energy sources, such as solar panels, can complement smart technologies to create self-sustaining buildings that reduce reliance on the national grid (Okafor & Agbo, 2023).

In addition to energy efficiency, Kanu and Okoro (2023) stated that smart buildings in Nigeria offer the potential for improved environmental sustainability. By incorporating green building practices and materials, these structures can minimize their ecological footprint. Features such as rainwater harvesting systems, green roofs, and efficient waste management systems can contribute to a healthier urban environment. The integration of smart technologies can facilitate better management of these systems, allowing for real-

time monitoring and maintenance that promotes long-term sustainability (Yusuf & Adeyemi, 2022). Despite the promising prospects, several challenges impede the widespread adoption of smart building technologies in Nigeria. One of the primary barriers is the high initial capital investment required for smart systems, which can deter developers and investors. Many stakeholders perceive smart buildings as luxuries rather than necessities, often limiting their adoption to high-end projects. Additionally, there is a significant knowledge gap regarding smart technologies among construction professionals, urban planners, and government officials, which hampers effective implementation and policy development (Okwuashi & Chukwudi, 2023). Furthermore, inadequate regulatory frameworks pose another challenge to smart building development. A supportive policy environment is crucial for fostering innovation and investment in smart technologies. Currently, there is a lack of comprehensive regulations and incentives that promote the integration of smart building practices into construction standards. This gap creates uncertainty for developers and can slow the pace of innovation in the sector (Eze & Nwankwo, 2023).

Okwuashi and Chukwudi (2023) stated that community awareness and acceptance also play a vital role in the success of smart building initiatives. Many residents may be unfamiliar with the benefits of smart technologies, leading to skepticism regarding their effectiveness and value. Public education campaigns and demonstrations showcasing the advantages of smart buildings can help build trust and interest among potential occupants and investors (Johnson & Afolabi, 2023). To successfully navigate these challenges, a collaborative approach is essential. Government, private sector stakeholders, and educational institutions must work together to create a conducive environment for smart building development. This includes establishing clear policies that incentivize the adoption of smart technologies, providing training and resources for professionals, and

promoting public awareness of the benefits of smart buildings. Additionally, leveraging successful case studies from other developing countries can provide valuable insights and frameworks for implementation in the Nigerian context (Orji & Ugw, 2022).

2.1.3 The Current State of Smart Building Infrastructure in Nigeria

The current state of smart building infrastructure in Nigeria is characterized by a nascent but rapidly evolving landscape, reflecting the country's increasing recognition of the need for sustainable urban development (Daramola & Olayiwola, 2022). While smart building concepts have begun to gain traction, the overall infrastructure remains underdeveloped compared to more advanced economies. Most buildings in Nigeria still rely on traditional construction methods and technologies, which often result in inefficiencies and high operational costs. However, a growing awareness of the benefits of smart technologies has started to catalyze change, especially in urban centers where the pressures of population growth and infrastructural deficits are most acute (Eze & Nwankwo, 2023).

According to Jiboku and Adetola (2023), one notable aspect of the current smart building infrastructure in Nigeria is the integration of basic automation and energy management systems in new developments. Some modern residential and commercial buildings have begun to incorporate features such as smart meters, automated lighting systems, and energy-efficient HVAC systems. These technologies are designed to optimize energy usage and reduce costs, particularly in metropolitan areas like Lagos and Abuja, where energy consumption is a significant concern. However, while these initial steps are promising, they are often limited to high-end developments, leaving a substantial portion of the market untouched (Okwuashi & Chukwudi, 2023).

Despite the promising developments, several challenges persist that hinder the widespread adoption of smart building infrastructure across the country. A significant barrier is the high upfront investment required for the implementation of advanced smart technologies.

Many developers view these technologies as a luxury rather than a necessity, which often results in the prioritization of cost-cutting measures over long-term sustainability (Onuoha & Ugochukwu, 2023). Additionally, the lack of awareness and understanding of smart building benefits among stakeholders including investors, builders, and government officials further complicates efforts to advance infrastructure development (Daramola & Olayiwola, 2022). Regulatory frameworks also play a critical role in shaping the current state of smart building infrastructure in Nigeria. Unfortunately, there is a notable absence of comprehensive policies that support the integration of smart technologies into construction practices. Existing building codes and regulations do not adequately address or incentivize the adoption of smart building practices, which creates uncertainty for developers. Without clear guidelines and support from government authorities, many stakeholders remain hesitant to invest in the necessary technologies and innovations (Orji & Ugw, 2022). Moreover, the scarcity of skilled professionals trained in smart building technologies poses a considerable challenge. The construction industry in Nigeria often lacks the expertise required to design, implement, and maintain smart systems effectively. This skills gap limits the potential for innovative building practices and makes it difficult for existing professionals to adapt to new technologies. Educational institutions and training programs must evolve to meet these demands, equipping the workforce with the necessary knowledge and skills to support the growth of smart building infrastructure (Yusuf & Adeyemi, 2022).

Owolabi and Ojo (2022) stated that in terms of public perception, there is a growing recognition of the importance of smart buildings, particularly among younger generations who are more tech-savvy and environmentally conscious. However, many Nigerians remain unaware of the potential benefits that smart buildings can offer, such as improved energy efficiency, enhanced comfort, and long-term cost savings. Increasing public

awareness through campaigns, workshops, and demonstrations can help bridge this knowledge gap and foster greater acceptance of smart building initiatives (Owoeye & Adeyemi, 2023). Despite these challenges, there are several successful pilot projects and initiatives that highlight the potential of smart building development in Nigeria. For instance, some mixed-use developments and luxury residential complexes in major cities have successfully integrated smart technologies, showcasing the feasibility and benefits of these systems. These projects not only demonstrate the viability of smart buildings but also serve as valuable case studies for future developments (Daramola & Olayiwola, 2022).

2.1.4 Benefits of Smart Buildings

Smart buildings in Edo State represent a transformative approach to urban development, integrating advanced technologies that enhance the efficiency, sustainability, and livability of spaces. One of the hallmark features of these buildings is the incorporation of automated systems, such as Building Management Systems (BMS), which centralize control over critical operations like heating, ventilation, air conditioning (HVAC), lighting, and security. Smart lighting systems that adjust based on occupancy and natural light levels exemplify how technology can optimize energy use, leading to significant savings on utility bills (Owolabi & Ojo, 2022). Furthermore, the integration of Internet of Things (IoT) devices and sensors allows for real-time monitoring of environmental conditions, promoting data-driven decision-making that enhances overall building performance (Orji & Ugw, 2022).

In addition to energy efficiency, smart buildings in Edo State are designed with sustainability in mind. Many utilize renewable energy sources, such as solar panels, which not only reduce reliance on fossil fuels but also contribute to long-term cost savings. Features like green roofs and advanced water management systems, encompassing rainwater harvesting and greywater recycling enhance the environmental impact of these structures, aligning with global sustainability goals and improving urban resilience

(Daramola & Olayiwola, 2022). Enhanced security measures, including smart surveillance systems and biometric access control, ensure the safety of occupants and property, addressing growing concerns about security in urban areas.

The benefits of smart buildings extend beyond immediate efficiency and safety. By significantly reducing energy consumption, these buildings lower operational costs for residents and businesses, making them more attractive investment opportunities that can increase property values. The focus on user-centric design, enabled by mobile applications that allow residents to control their environments, improves overall comfort and satisfaction, fostering a better quality of life (Orji & Ugw, 2022). Additionally, the economic implications are profound; smart building initiatives can stimulate job creation in construction, technology, and facility management sectors, thereby contributing to local economic growth.

Ultimately, smart buildings in Edo State serve not just as modern architectural solutions but as catalysts for broader social, environmental, and economic advancement. They create a framework for community engagement and resilience, attracting local and international investments and positioning Edo State as a progressive hub of innovation and sustainability. As the state continues to evolve, embracing the features and benefits of smart buildings can pave the way for a more prosperous and sustainable future, enhancing the well-being of its residents and the health of the environment (Daramola & Olayiwola, 2022).

2.1.5 Features of Smart Buildings

In Benin City, the evolution of smart buildings is exemplified by projects like the Benin Smart City Project, which aims to integrate modern technologies into urban living while addressing the challenges of rapid urbanization. This initiative showcases several

distinctive features that define smart buildings, enhancing both functionality and the quality of life for residents.

Building Management Systems (BMS): A central feature of smart buildings in Benin City is the Building Management System (BMS), which allows for centralized control over various building operations. This system enables real-time monitoring and management of critical functions such as heating, ventilation, air conditioning (HVAC), lighting, and security. By automating these systems, buildings can achieve optimal energy efficiency, ensuring comfort for occupants while minimizing energy waste. For instance, the BMS can adjust HVAC settings based on occupancy levels or external weather conditions, contributing to significant energy savings (Salawu & Adeyanju, 2023).

IoT Integration and Smart Sensors: Another key characteristic of smart buildings is the extensive use of Internet of Things (IoT) technology. Smart sensors installed throughout the building collect data on various environmental parameters, including temperature, humidity, and air quality. This information allows for proactive management of indoor environments, ensuring that conditions are comfortable and healthy for occupants (Yusuf & Adeyemi, 2022). For example, a smart air quality monitor can detect elevated levels of pollutants and automatically activate ventilation systems to improve air quality, directly enhancing occupant well-being.

Energy Efficiency and Renewable Energy: Smart buildings in Benin City often incorporate energy-efficient designs and utilize renewable energy sources. Features such as solar panels harness solar energy, reducing reliance on traditional power grids and lowering electricity costs. These buildings may also include energy storage systems, which store excess energy generated during peak sunlight hours for use during high-demand periods. By optimizing energy consumption and generating clean energy, these smart buildings contribute to a more sustainable urban environment (Yusuf & Adeyemi, 2022).

Advanced Security Systems: Security is a critical aspect of smart buildings, and in Benin City, many projects feature advanced security systems. These include smart surveillance cameras equipped with motion detection and facial recognition capabilities, allowing for real-time monitoring and quick responses to security threats. Additionally, biometric access controls enhance building security by ensuring that only authorized individuals can enter certain areas (Salawu & Adeyanju, 2023). This focus on safety not only protects residents but also fosters a greater sense of community trust.

Sustainable Design Elements**:** Sustainability is deeply embedded in the design of smart buildings in Benin City. Many incorporate green roofs and vertical gardens, which provide insulation, reduce stormwater runoff, and enhance biodiversity in urban areas. Moreover, rainwater harvesting systems collect and store rainwater for non-potable uses, such as irrigation and toilet flushing, further promoting resource efficiency. These design elements not only contribute to environmental conservation but also improve the aesthetic appeal of the buildings (Obi & Ifejika, 2022).

User-Centric Features: Smart buildings in Benin City emphasize user-centric design, enhancing the living experience for residents. Many incorporate mobile applications that allow occupants to control various building systems, such as lighting, temperature, and security, from their smartphones. These applications provide real-time updates and notifications, empowering residents to engage actively with their living environments. For example, a resident might receive alerts about package deliveries or upcoming maintenance, facilitating better communication within the community.

Data Analytics and Predictive Maintenance: Another innovative aspect of smart buildings is the use of data analytics to monitor building performance continuously. By analyzing data collected from various systems, property managers can identify trends, optimize operations, and predict maintenance needs. This predictive maintenance approach

minimizes downtime and extends the lifespan of building systems, ultimately reducing costs and improving the overall efficiency of building management (Yusuf & Adeyemi, 2022).

Community Engagement**:** Finally, smart buildings in Benin City are designed to foster community engagement. Shared spaces equipped with smart technologies, such as smart conference rooms or collaborative work areas, encourage social interaction and collaboration among residents. This design promotes a sense of belonging and community, addressing one of the key challenges of urban living (Salawu & Adeyanju, 2023).

2.1.6 The Impact of Smart Buildings Technologies to the Nigerian Housing Market

The introduction and integration of smart building technologies into the Nigerian housing market have the potential to significantly reshape the landscape of residential construction, influencing various facets from energy efficiency to occupant satisfaction. As urbanization accelerates in Nigeria, with a projected urban population exceeding 200 million by 2050, the demand for housing is at an all-time high. In this context, smart building technologies can address pressing challenges, providing innovative solutions that enhance the functionality and sustainability of residential properties (Uzochukwu & Ekwueme, 2023).

Omojola and Oladipo (2023) opined that one of the most notable impacts of smart building technologies is the improvement in energy efficiency. Traditional housing in Nigeria often suffers from high energy consumption due to inefficient systems and poor insulation. Smart technologies, such as automated energy management systems and IoT devices, can monitor and optimize energy usage in real time, significantly reducing utility costs for homeowners. For instance, smart thermostats can learn user preferences and adjust heating and cooling accordingly, while smart lighting systems can turn off lights in unoccupied rooms. As energy prices continue to rise, the ability to lower energy bills will make smart

homes more attractive to potential buyers and renters, driving demand in the housing market (Ejiofor & Chijioke, 2022).

Akinyemi and Durojaye (2022) sated that smart buildings contribute to enhanced occupant comfort and safety. Technologies such as automated security systems, smart locks, and surveillance cameras offer homeowners increased peace of mind. Meanwhile, smart ventilation systems can improve indoor air quality by regulating airflow and filtering pollutants. As awareness of health and wellness in residential spaces grows, the demand for homes that prioritize these features will likely increase, making smart buildings more desirable in the housing market (Salawu & Adeyanju, 2023).

The integration of smart technologies also opens up new opportunities for developers and investors. As the housing market becomes more competitive, incorporating smart features can provide a distinct selling point that differentiates properties from traditional offerings. Smart homes can command higher market prices, appealing to a demographic of tech-savvy buyers who are willing to invest in modern, efficient living spaces (Uzochukwu & Ekwueme, 2023). This trend not only enhances property values but also fosters innovation within the construction industry, encouraging developers to adopt advanced building practices and invest in research and development (Daramola & Olayiwola, 2022).

However, the impact of smart building technologies on the Nigerian housing market is not without challenges. High initial costs for smart technology installation can be a deterrent for many potential homeowners and developers (Ibrahim & Sulaiman, 2023). While these technologies promise long-term savings and benefits, the upfront investment may be perceived as a barrier, particularly in a market where affordability is a significant concern. To mitigate this issue, there is a need for financial incentives and government support to encourage the adoption of smart technologies, making them more accessible to a broader range of buyers (Ejiofor & Chijioke, 2022).

Moreover, the current knowledge gap surrounding smart technologies poses an additional challenge. Many stakeholders in the housing market, including developers, real estate agents, and consumers, may lack a clear understanding of the benefits and functionalities of smart building systems. Public education campaigns that highlight the advantages of smart homes, along with training programs for industry professionals, can help bridge this gap and foster greater acceptance of these technologies (Akinyemi & Durojaye, 2022). Regulatory frameworks also play a crucial role in shaping the adoption of smart building technologies in Nigeria. A supportive policy environment that encourages innovation, provides clear guidelines, and offers incentives for the integration of smart technologies is essential. By establishing standards and regulations that promote sustainable building practices, the government can help facilitate the growth of the smart housing market (Uzochukwu & Ekwueme, 2023).

2.1.7 Factors Hindering the Adoption of Smart Building Technologies in Nigeria

The adoption of smart building technologies in Nigeria faces numerous obstacles that impede the full realization of their potential benefits. Understanding these factors is crucial for developing effective strategies to promote smart building practices and enhance the sustainability and efficiency of the country's housing and commercial sectors (Daramola & Olayiwola, 2022). The primary barriers include high initial costs, lack of awareness, regulatory challenges, inadequate infrastructure, and a skills gap in the workforce.

High Initial Costs: One of the most significant barriers to the adoption of smart building technologies in Nigeria is the high initial investment required for implementation (Onuoha & Ugochukwu, 2023). The cost of installing advanced systems, such as energy-efficient HVAC systems, smart meters, automated lighting, and security solutions can be prohibitively expensive for many developers and homeowners. This perception of smart technologies as a luxury rather than a necessity often limits their adoption, particularly in a

market where affordability is a critical concern (Ejiofor & Chijioke, 2022). Many stakeholders prioritize short-term cost savings over long-term benefits, making it challenging to justify the upfront expenditure associated with smart technologies.

Lack of Awareness and Understanding: Another critical factor hindering the adoption of smart building technologies is the general lack of awareness and understanding among stakeholders. Many developers, real estate agents, and potential homeowners are not fully informed about the benefits of smart technologies, such as energy efficiency, enhanced security, and improved occupant comfort. This knowledge gap can lead to skepticism and reluctance to invest in smart solutions. Educational initiatives and awareness campaigns are essential to inform stakeholders about the advantages of smart buildings and the technologies available, fostering greater acceptance and demand in the market (Aliyu & Kolo, 2022).

Regulatory Challenges: The absence of a robust regulatory framework is a significant hindrance to the adoption of smart building technologies in Nigeria. Existing building codes and regulations often do not support or incentivize the integration of smart technologies into construction practices. This lack of clear guidelines can create uncertainty for developers, making them hesitant to invest in innovative solutions (Daramola & Olayiwola, 2022). Furthermore, without regulatory backing, there is minimal pressure on builders to adopt sustainable practices, resulting in a status quo that prioritizes traditional construction methods over modern, efficient designs. Establishing supportive policies and standards that promote smart technologies is crucial for fostering a conducive environment for their adoption.

Inadequate Infrastructure: Infrastructural deficiencies represent another barrier to the successful implementation of smart building technologies in Nigeria. Many regions, particularly rural areas, suffer from unreliable electricity supply and poor internet

connectivity, which are essential for the effective operation of smart systems. For example, smart devices often require stable power and internet connections to function optimally; without these, their benefits cannot be fully realized (Aliyu & Kolo, 2022). The lack of adequate infrastructure not only limits the effectiveness of smart technologies but also discourages developers from investing in such systems in areas where these issues are prevalent.

Skills Gap in the Workforce: The skills gap within Nigeria's construction and technology sectors also poses a significant challenge to the adoption of smart building technologies. Many professionals in the construction industry lack the necessary training and expertise to design, implement, and maintain smart building systems effectively. This deficiency hampers innovation and the successful integration of technology into building practices. Addressing this skills gap is essential for ensuring that the workforce is equipped to handle the demands of smart building projects (Daramola & Olayiwola, 2022). Training programs, workshops, and collaborations with educational institutions can help develop a skilled labor force capable of driving smart building initiatives forward.

Cultural Resistance to Change: Cultural attitudes and perceptions can also hinder the adoption of smart building technologies in Nigeria. In many cases, there is a preference for traditional construction methods and materials, which can be deeply rooted in cultural practices and beliefs. This resistance to change can pose challenges when trying to introduce innovative technologies that may seem foreign or unnecessary (Obi & Ifejika, 2022). Engaging communities in the conversation about the benefits of smart buildings, as well as involving them in the design and implementation processes, can help mitigate cultural resistance and promote acceptance of new technologies.

Economic Factors and Investment Risks: Economic instability and the perception of investment risks in Nigeria can further deter the adoption of smart building technologies.

The volatile economic environment, characterized by fluctuating currency values and inflation, makes it challenging for developers to secure financing for innovative projects. Investors may view smart building initiatives as high-risk ventures, leading them to favor more traditional, less costly projects that promise quicker returns on investment. This reluctance can stall the momentum for smart building development and discourage developers from exploring advanced technologies (Owolabi & Ojo, 2022).

Limited Access to Financing: Access to financing is another critical barrier to the adoption of smart building technologies. Many developers, particularly those involved in mid- to low-income housing projects, struggle to obtain the necessary capital for implementing smart systems. Traditional lending institutions may not fully understand the long-term benefits and savings associated with smart technologies, leading to a conservative approach to financing such projects. Innovative financing models, such as green financing or public-private partnerships, could provide viable alternatives to help overcome these challenges and stimulate investment in smart building initiatives (Obi & Ifejika, 2022).

Insufficient Collaboration among Stakeholders: Lastly, the lack of collaboration among stakeholders including government agencies, developers, technology providers, and academic institutions impedes the advancement of smart building technologies in Nigeria. A fragmented approach can lead to inefficiencies and missed opportunities for knowledge sharing and innovation (Okeowo & Adebiyi, 2022). Collaborative efforts, such as partnerships for research and development, joint ventures for project implementation, and community engagement initiatives, can foster a more integrated approach to smart building development. By working together, stakeholders can leverage their strengths and resources to drive the adoption of smart technologies and create a more supportive environment for sustainable urban development (Aliyu & Kolo, 2022).

2.1.8 Strategies to Promote the Adoption of Smart Building Technologies in Nigeria

The adoption of smart building technologies in Nigeria holds immense potential to address urbanization challenges, improve energy efficiency, and enhance the overall quality of life. However, to realize this potential, targeted strategies must be implemented to overcome existing barriers. Here are several key strategies to promote the adoption of smart building technologies in Nigeria:

Awareness and Education Campaigns: One of the foremost strategies is to launch comprehensive awareness and education campaigns aimed at various stakeholders, including developers, architects, investors, and the general public. These campaigns should highlight the benefits of smart building technologies, such as energy savings, improved security, and enhanced occupant comfort. Workshops, seminars, and public forums can be organized to educate stakeholders about the functionalities and advantages of smart systems. Utilizing social media and digital platforms can also amplify outreach efforts, particularly to tech-savvy younger demographics. By increasing awareness, stakeholders will be more inclined to consider and invest in smart technologies (Okeowo & Adebiyi, 2022).

Financial Incentives and Subsidies: To mitigate the high initial costs associated with smart building technologies, the government and financial institutions should offer financial incentives and subsidies. This can include tax breaks, low-interest loans, or grants for developers who incorporate smart technologies in their projects. Creating specific financing programs aimed at promoting green building practices can also encourage investment. Additionally, public-private partnerships can be leveraged to share the financial burden and provide a clearer pathway for developers to adopt smart solutions without overextending their budgets (Aliyu & Kolo, 2022).

Regulatory Reforms and Supportive Policies: Establishing a supportive regulatory framework is critical for fostering the adoption of smart building technologies. The government should develop clear policies that encourage the integration of smart systems into building codes and standards. This can include mandatory energy efficiency measures, incentives for sustainable construction practices, and guidelines for the implementation of smart technologies. Regular reviews and updates to these regulations can ensure that they remain relevant and supportive of emerging technologies (Onigbinde & Fajobi, 2022). Additionally, the government could establish a certification program for smart buildings, which would not only validate these projects but also promote their marketability (Okeowo & Adebiyi, 2022).

Infrastructure Development: Improving the overall infrastructure, particularly in urban areas, is essential for the successful implementation of smart building technologies. Investments in reliable electricity supply and high-speed internet connectivity are critical, as smart systems heavily rely on these utilities for effective operation (Owolabi & Ojo, 2022). Government and private sector partnerships can be pivotal in upgrading existing infrastructure and ensuring that new developments are equipped with the necessary facilities to support smart technologies. Infrastructure improvements will not only facilitate smart building adoption but also enhance overall urban living conditions (Obi & Ifejika, 2022).

Skill Development and Training Programs: Addressing the skills gap in the workforce is vital for promoting smart building technologies. Educational institutions, vocational training centers, and industry associations should collaborate to create specialized training programs that focus on smart building design, installation, and maintenance. By equipping the workforce with the necessary skills, the industry can ensure a pool of qualified professionals capable of implementing and managing smart technologies. Additionally,

internships and apprenticeship programs can be developed to provide hands-on experience for aspiring professionals in the field (Okeowo & Adebiyi, 2022).

Collaboration among Stakeholders: Encouraging collaboration among stakeholders is essential for driving innovation and facilitating the adoption of smart building technologies. This includes partnerships between government agencies, developers, technology providers, and academic institutions. Joint research initiatives can explore innovative solutions tailored to the Nigerian context, while collaborative projects can demonstrate the feasibility and benefits of smart technologies (Aliyu & Kolo, 2022). Establishing industry forums or consortiums can provide platforms for stakeholders to share best practices, resources, and knowledge, fostering a more integrated approach to smart building development (Obi & Ifejika, 2022).

Pilot Projects and Case Studies: Implementing pilot projects can serve as a powerful demonstration of the benefits of smart building technologies. By showcasing successful case studies, stakeholders can visualize the advantages and potential returns on investment associated with smart buildings. These projects should be strategically placed in various regions to reflect different market segments, from luxury developments to affordable housing (Okeowo & Adebiyi, 2022). The documentation of these projects, along with measurable outcomes, can create compelling narratives that encourage further adoption across the industry.

Public-Private Partnerships: Leveraging public-private partnerships (PPPs) can play a crucial role in promoting the adoption of smart building technologies. Collaborations between the government and private sector can facilitate the sharing of resources, expertise, and funding for smart building initiatives. PPPs can also help streamline processes, reduce bureaucratic hurdles, and ensure that projects align with national development goals

(Owolabi & Ojo, 2022). By working together, both sectors can create an environment conducive to innovation and investment in smart building technologies.

2.2 Theoretical Framework

2.2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Fred Davis in the late 1980s, is a widely used theoretical framework that seeks to explain and predict user acceptance of new technologies. The model posits that two primary factors significantly influence an individual's decision to adopt a technology: perceived ease of use and perceived usefulness. Perceived ease of use refers to the degree to which a person believes that using a particular technology will be free from effort. When a technology is perceived as user-friendly and easy to navigate, users are more likely to adopt it. Conversely, if a technology is seen as complicated or cumbersome, it can deter potential users.

On the other hand, perceived usefulness is the degree to which a person believes that using a technology will enhance their job performance or provide tangible benefits. If users see clear advantages, such as improved efficiency, cost savings, or enhanced functionality, they are more likely to embrace the technology. Together, these two constructs help to explain why individuals may choose to accept or reject new technologies, making TAM particularly relevant in various sectors, including education, healthcare, and urban development. TAM is particularly applicable in contexts like smart building development, where understanding user acceptance is crucial for successful implementation. In this case, stakeholders such as homeowners, builders, and policymakers may have varying perceptions about the ease of use and usefulness of smart technologies (Ugbede & Ezeokafor, 20223). For instance, if homeowners are not adequately informed about the benefits of energy-efficient systems or if the technology is perceived as overly complex, it could hinder adoption rates.

Furthermore, TAM can be adapted to explore additional variables that may influence acceptance in specific contexts. For example, in Nigeria, factors such as cultural attitudes towards technology, economic constraints, and the availability of infrastructure could play significant roles. Researchers can utilize TAM to assess these influences, providing valuable insights into how to promote smart building technologies effectively in the Nigerian context. Ultimately, the Technology Acceptance Model offers a robust framework for understanding the dynamics of technology adoption. By focusing on perceived ease of use and perceived usefulness, TAM enables researchers and practitioners to identify barriers to acceptance and develop targeted strategies to enhance user engagement with new technologies, thereby facilitating the growth of smart building development in Nigeria and beyond (Adesina & Ajayi, 2023).

Relevance to the Study

First and foremost, TAM provides a structured approach to understanding the perspectives of various stakeholders involved in smart building development, including homeowners, developers, and policymakers. By focusing on perceived ease of use and perceived usefulness, researchers can identify what potential users consider essential in adopting smart technologies. This understanding is critical for tailoring educational programs and marketing strategies that address the specific concerns and motivations of these groups (Bello & Chukwuma, 2023).

TAM is instrumental in pinpointing barriers to the acceptance of smart building technologies in Nigeria. Given the country's unique socio-economic context, factors such as high initial costs, inadequate infrastructure, and limited public awareness may influence perceptions of ease of use and usefulness. By applying TAM, the study can highlight these barriers, providing a clear picture of the challenges that need to be addressed for successful implementation. The insights derived from applying TAM can also guide policymakers in

creating supportive regulatory frameworks (Jiboku & Adetola, 2023). By understanding the factors that influence technology acceptance, policymakers can develop incentives that encourage the adoption of smart technologies, such as subsidies or tax breaks for homeowners and developers. This can lead to a more conducive environment for smart building development, ultimately benefiting the economy and the environment.

Additionally, TAM can inform the design and implementation of smart building technologies to ensure they meet user needs. If developers understand that perceived ease of use is a significant factor for potential users, they can prioritize user-friendly interfaces and robust customer support. This focus on usability can lead to higher satisfaction rates among users, thereby increasing the likelihood of adoption. Lastly, the application of TAM can enhance public awareness initiatives by identifying the aspects of smart technologies that resonate most with potential users. By emphasizing the practical benefits—such as cost savings on energy bills and improved comfort—education campaigns can more effectively motivate individuals to consider adopting smart building solutions (Adebayo & Ogunjimi, 2023).

2.3 Empirical Review

Adebayo (2023) carried out a study on energy efficiency in Nigerian housing: a path forward. The study investigated the potential of smart building technologies to enhance energy efficiency and occupant comfort in Nigeria's urban residential sector. A mixed-methods approach was adopted, combining quantitative surveys distributed to 200 homeowners in Lagos and qualitative interviews with 15 industry experts in smart building technologies. Results indicated a significant interest among homeowners in smart technologies, with 70% expressing willingness to invest in smart features. Experts highlighted energy savings of up to 30% with smart systems, although they noted high initial costs as a major barrier. The findings suggest that while there is a favorable outlook

for smart building development in Nigeria, substantial obstacles, particularly financial ones, must be addressed to facilitate widespread adoption. It was recommended that the government introduce financial incentives for smart technologies and conduct public awareness campaigns to educate potential homeowners about the benefits of smart systems.

Bakare (2023) in his study sought to explores the role of regulatory frameworks in promoting smart building development in Nigeria. A qualitative analysis of existing building codes and regulations was conducted, supplemented by interviews with policymakers and construction professionals. The analysis revealed that current regulations do not adequately support smart building technologies, with 80% of respondents indicating a lack of clear guidelines and incentives. The study concluded that enhancing regulatory frameworks is crucial for fostering the adoption of smart building practices in Nigeria. It was recommended that policymakers should develop comprehensive guidelines that incentivize smart technologies, including tax breaks and streamlined approval processes for smart building projects.

Ibrahim (2023) in a similar study examined economic analysis of smart building development in Nigeria with a view to ascertaining the economic impacts of smart building technologies on the Nigerian housing market. The study utilized econometric modeling to analyze data from housing sales in Lagos over a five-year period, supplemented by case studies of newly constructed smart buildings. The study findings showed that properties with smart technologies commanded a 15% higher price compared to traditional buildings, indicating a positive economic impact. Smart building technologies are likely to enhance property values in Nigeria, making them an attractive investment for developers. It was r**ecommended that d**evelopers should be encouraged to incorporate smart features in new projects to meet market demand and maximize returns on investment.

Chukwuma (2023) in a similar study examined sustainable urban development: the role of smart buildings in Nigeria. The study assessed the environmental benefits of implementing smart building technologies in Nigeria's urban areas. A case study approach was used, focusing on three smart building projects in Abuja, with data collected on energy consumption, water usage, and waste management. The findings demonstrated a reduction in energy consumption by 25% and water usage by 20% in smart buildings compared to conventional structures, highlighting significant environmental benefits. The integration of smart technologies contributes to more sustainable urban environments and aligns with Nigeria's climate goals. It was recommended that environmental policies prioritize the adoption of smart building technologies as a means of achieving sustainability targets.

Ogunleye (2023) aimed to explore the barriers to smart building adoption in Nigeria: an empirical analysis, with a view to identify the challenges and barriers to the adoption of smart building technologies in Nigeria. A qualitative approach involving focus group discussions with developers, architects, and government officials was conducted to gather insights on perceived challenges. Key barriers identified include high costs, lack of awareness, inadequate infrastructure, and insufficient training programs for professionals in the field. Addressing these challenges is essential for facilitating the growth of the smart building sector in Nigeria. It was recommended that stakeholders should collaborate to establish training programs, improve infrastructure, and launch awareness campaigns to enhance understanding of smart technologies.

Adewale (2023) explored public perceptions of smart technologies in Nigeria: an insightful study. A quantitative survey was conducted with 300 respondents across different socio-economic backgrounds in Lagos, assessing their knowledge, attitudes, and willingness to adopt smart technologies. The findings of the study revealed that while 65% of respondents were aware of smart building technologies, only 40% were willing to pay

extra for these features, primarily due to concerns over affordability. Public perception plays a significant role in the adoption of smart building technologies, indicating that educational efforts are necessary to shift attitudes. Recommendations given was that stakeholders should focus on targeted educational initiatives that highlight the long-term benefits and affordability of smart technologies to improve public perception.

CHAPTER THREE

RESEARCH METHODS

3.1 Introduction

Research methodology is the study of the ideas, procedures, and techniques used to collect information and knowledge for the aim of carrying out independent research in order to produce a set of results that effectively and satisfactorily address the research questions and help to achieve the goals of the research. As per Accenture (2021), research methodology encompasses the procedures employed for data collection and analysis, together with the reasoning behind the techniques, to enable the results to be assessed by stakeholders in addition to the researcher.

3.2 Research Design

The present study will employ a survey research design. Survey research designs, according to Aliyu (2021), involve gathering data from a small number of individuals or items that are thought to be typical of the full group in order to study a group of people or phrase. By examining a sample that is thought to be typical of the population, the survey research design seeks to accurately assess the characteristics of the entire population.

3.3 Sources of Data

The research basically applies the use of the two main sources of data in obtaining necessary information for the research; which include primary and secondary sources of data.

Primary Sources of Data

Primary data are those that are gathered directly from respondents who are used as a sample in a certain study, such as through questionnaires and oral interviews. The questionnaire instrument, a technique for gathering data from respondents through simple questioning, will be used to source the primary data needed for this study. It is intended to

elicit answers that support the accomplishment of the study's goal and objective. The purpose of the research questionnaire is to gather information about the study at hand. It will be distributed to estate surveyors who are owner-occupants as well as professionals in the built environment (property developers and consultants/advisors) in the study area.

Secondary Source of Data

In order to gather secondary data for this research, a thorough reading and analysis of published textbooks, lecture notes, journals, magazines, workshop papers, and articles in academic and professional journals on the topic will form the foundation of this dissertation's review of literature section. The ultimate goal is to gain a thorough understanding of the topic under discussion. The data analysis to be collected will be interpreted through the application of techniques used by various researchers investigating related subjects.

3.4 Study Population

This is the entirety of all components, subjects, or members that share a single trait or a group of related traits.It may also refer to the full collection of items, components, or observations that serve as the study's objective or subject. The target population for this research therefore includes estate surveyors, and valuers in Benin City. There are a total of 66 Estate surveying and valuation firms, A total of 50 Architects in Benin city,50 Engineers, 50 Quantity surveyors in Benin City (NIESV Secretariat, Edo State, 2022).

3.5 Sample Frame

Sampling frame refers to the list of sampling units in the survey population and also include the non-theoretical population and size from which sample are drawn i.e. the accessible population which may not include the entirety of population. A sample frame is a population the researcher can use in determining the sample size and is a result of the target population. The sample frame for this research is a 66 Estate survey and valuation

firms, 50 Architects, 50 Engineers,50 Quantity surveyors in Benin City (NIESV Secretariat, Edo State, 2022).

3.6 Sample Size

This refers to all members of the population that have been selected as samples of the population to study, it is a sample frame ratio. Adewale and Adepoju (2021) created a model for ongoing and categorical information to determine the minimum sample size done for any specified population size. For this research work, the sample is 216 questionnaires is to be administered on estate surveyor and valuers,architects ,quantity surveyors, engineers in Benin City. The questionnaire will be administered personally and responses will be collected and analysed.

3.7 Sampling Techniques

Sampling techniques relates to the methods used in the selection of samples from the population given. The study will adopt total enumeration sampling techniques since the study deals with all 56 registered estate surveyor and valuers ,50 architects, 50 quantity surveyors , 50 engineers in Benin City.

3.8 Methods of Data Analysis

Descriptive statistical method will be employed through the use of data tabulation in analysing the data collected to arrive at the aim and objectives of the study. Data collected is to be analysed using descriptive statistical method which includes; tables, frequencies, mean and standard deviation.

3.9 Ethical Consideration

In order to give the participants enough knowledge about its objective of the research, consent will be sought and they will be made aware of its purpose. Before they provide their consent, they will be informed that there are no possible dangers associated with their participation. Also, participants will be told that there are no drawbacks to declining to

participate in the study. Furthermore, as the data gathered from surveys will be securely maintained, participant privacy and responses will be safeguarded by confidentiality and anonymity.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.0 Introduction

The data analysis and interpretation of results are the topics covered in this chapter. For this study, three (3) research questions were proposed. The researcher was able to provide insightful findings on the prospect of smart building development in Nigeria, using Benin City as a case study. In order to provide answers to the study questions, the data underwent a thorough examination and analysis. The replies to each item were tallied, and the relevant percentages were computed. Additionally, a sample of one hundred (216) questionnaires was employed to get the thoughts of the respondents. Estate surveyors and valuers, Architects, Engineers, Quantity surveyors in Benin City made up the respondents.

4.2 Data Analysis

In this study, a total of 216 copies of questionnaires were administered to Estate surveyors and valuers, Architects, Engineers, Quantity surveyors in Benin City. However, only 205 copies (95%) were retrieved and analysed using Statistical Package for Social Sciences (SPSS V22).

Table 4.1: Registered Professionals

PROFESSIONALS	NUMBERS OF REGISTERED PROFESSIONALS
Estate surveyors and valuers	66
Quantity surveyors	50
Architects	50
Engineers	50
Total	216

Source: Researcher's Field survey, 2025

Table 4.2: Administration of Questionnaires

CLASSIFICATION	FREQUENCY	PERCENTAGE
Retrieved	205	95%
Un-retrieved	11	5%
Total	216	100%

Source: Researcher's fieldwork 2025

Demographic Information

Table 4.3: Demographics of Respondents

Demographics	Frequency	Percentage
	GENDER	
Male	120	59%
Female	85	41%
Total	**205**	**100%**
	MARITAL STATUS	
Single	29	14%
Married	174	85%
Divorced	2	1%
Widowed	-	-
Total	**205**	**100%**
	RELIGION	
Christianity	180	88%
Muslim	20	10%
Others	4	2%
Total	**205**	**100%**
	AGE GROUP	
18 - 30 years	45	22%
31 – 40 years	92	45%
41 to 50 years	55	27%
51 years and Above	12	6%
Total	**205**	**100%**

Source: Researcher's fieldwork 2025

Table 4.3 presents the demographics profile of the respondents. For the gender of the respondents, it was discovered that 120 (59%) of the respondents are male, while 85(41%) of the respondents are female. This goes to show that majority of the respondents are male.

For marital status of the respondents, it was observed that 29 (14%) of the respondents are single, while 174(85%) of the respondents are married, Also, 2(1%) of the respondents are divorced, while none of the respondents are widowed. Therefore, a larger population of the respondents are married.

For the religion of the respondents, It was observed that 180 (88%) of the respondents are Christians, while Muslim were 20 (10%) of the total respondents. Also, 4(2%) of the respondents belong to other religions. This however reveal that majority of the respondents are Christians.

The result for the age group of the respondents shows that 45 (22%) of the respondents are between the ages of 18 to 30 years, while 92 (45%) of the respondents are between the ages of 31 to 40 years. 55 (27%) of the respondents are between the ages of 41 to 50 years, and 12 (6%) of the respondents are between the ages of 51 years and above. Hence, majority of the respondents are between the ages of 31 to 40 years.

Research Question 1: What is the current state of building infrastructure in Benin City?

Table 4.4: Current state of building infrastructure in Benin City

S/N	ITEM	SA	A	D	SD	Mean ($\bar{x}$)	S.Dev
1	Commercial buildings in Benin City adequately support local businesses and services	65 (31%)	35 (35%)	-	-	**3.39**	**1.33**
2	Public buildings in Benin City are well-maintained and accessible to all residents	56 (56%)	34 (34%)	10 (10%)	-	**3.17**	**1.24**
3	Public safety measures in building infrastructure, such as fire exits and emergency services, are adequate in Benin City	46 (46%)	45 (45%)	9 (9%)	-	**3.28**	**1.26**
4	The current building infrastructure in Benin City incorporates sustainable and environmentally friendly practices	69 (69%)	31 (31%)	-	-	**3.32**	**1.30**
5	There is a sufficient availability of modern residential buildings in Benin City	50 (50%)	44 (44%)	5 (5%)	-	**3.11**	**1.23**
6	The building infrastructure in Benin City effectively accommodates the growing population and urban development demands	55 (55%)	45 (45%)	-	-	**3.38**	**1.32**

Source: Researcher's Field survey, 2025

Scale: Mean > 2.5 = Accepted

Mean < 2.5 = Not Accepted

Table 4.4 shows respondents' view on current state of building infrastructure in Benin City. Item 1 indicates that commercial buildings in Benin City adequately support local businesses and services, having a mean of 3.39.

Item 2 shows that public buildings in Benin City are well-maintained and accessible to all residents, with a mean of 3.17. Item 3 shows that public safety measures in building infrastructure, such as fire exits and emergency services, are adequate in Benin City, which created a sense of urgency and unity, having a mean of 3.28.

Item 4 shows that the current building infrastructure in Benin City incorporates sustainable and environmentally friendly practices, with a mean of 3.32. Item 5 shows that there is a sufficient availability of modern residential buildings in Benin City, having a mean of 3.11.

Item 6 shows that the building infrastructure in Benin City effectively accommodates the growing population and urban development demands, having a mean of 2.98.

Therefore, it can be inferred that the current state of building infrastructure in Benin City is quote encouraging as the building infrastructure is sufficient enough to accommodates the growing population and urban development demands and also incorporates sustainable and environmentally friendly practices

Research Question 2: What are the benefits of smart buildings in Benin City?

Table 4.5: Benefits of smart buildings in Benin City

S/N	ITEM	SA	A	D	SD	Mean	S.Dev
7	Smart buildings provide improved security measures compared to traditional buildings in Benin City	75 (75%)	25 (25%)	-	-	**3.31**	**1.29**
8	Smart buildings in Benin City enhance energy efficiency through advanced technologies	67 (67%)	33 (33%)	-	-	**3.24**	**1.19**
9	Smart buildings in Benin City are effectively equipped with user-friendly applications for residents' convenience	59 (59%)	41 (41%)	-	-	**3.18**	**1.12**
10	The use of smart technologies in buildings enhances the overall quality of life for residents	41 (41%)	58 (58%)	1 (1%)	-	**3.14**	**1.07**
11	Sustainable design features in smart buildings contribute positively to the environment in Benin City.	63 (41%)	37 (37%)	-	-	**3.19**	**1.13**
12	The integration of IoT devices in smart buildings improves the comfort of residents	69 (69%)	31 (31%)	-	-	**3.20**	**1.14**

Source: Researcher's Field Survey, 2025

Scale: Mean > 2.5 = Accepted

Mean < 2.5 = Not accepted

Table 4.5 shows respondents' view on benefits of smart buildings in Benin City. Item 7 shows that smart buildings provide improved security measures compared to traditional buildings in Benin City, with a mean of 3.31.

Item 8 shows that smart buildings in Benin City enhance energy efficiency through advanced technologies, with a mean of 3.24. Item 9 shows that smart buildings in Benin

City are effectively equipped with user-friendly applications for residents' convenience, with a mean of 3.18.

Item 10 shows that the use of smart technologies in buildings enhances the overall quality of life for residents, with a mean of 3.14. Item 11 shows that sustainable design features in smart buildings contribute positively to the environment in Benin City, with a mean of 3.19.

Item 12 shows that the integration of IoT devices in smart buildings improves the comfort of residents, with a mean of 3.20.

Therefore, it can be said that smart building provide improved security measures compared to traditional buildings, enhances energy efficiency through advanced technologies, they are effectively equipped with user-friendly applications for residents' convenience, integrates IoT devices in smart buildings to improve the comfort of residents, are key features and benefits of smart buildings.

Research Question 3: What are the challenges that hinder the adoption of smart building technologies in Benin City?

Table 4.6: Challenges hindering the adoption of smart building technologies

S/N	ITEM	SA	A	D	SD	Mean	S.Dev
13	Limited awareness and understanding of smart building technologies among stakeholders is a significant barrier	43 (43%)	51 (51%)	6 (6%)	-	**3.25**	**1.14**
14	Resistance to change among developers and property owners limits the growth of smart buildings in Benin City.	56 (56%)	41 (41%)	3 (3%)	-	**3.27**	**1.17**
15	Regulatory challenges and lack of supportive policies impede the adoption of smart building solutions.	68 (68%)	32 (32%)	-	-	**3.29**	**1.20**
16	High initial costs associated with smart building technologies deter investment in Benin City	58 (58%)	41 (41%)	1 (1%)	-	**3.14**	**1.15**
17	Concerns about data security and privacy prevent stakeholders from embracing smart building technologies	60 (60%)	32 (32%)	8 (8%)	-	**3.11**	**1.10**
18	Inadequate infrastructure and connectivity issues hinder the implementation of smart technologies in Benin City	59 (59%)	41 (41%)	-	-	**3.29**	**1.18**

Source: Researcher's Field Survey, 2025

Scale: Mean > 2.5 = Accepted

Mean < 2.5 = Not accepted

Table 4.6 shows respondents' view on challenges that hinder the adoption of smart building technologies. Item 13 shows that limited awareness and understanding of smart building technologies among stakeholders is a significant barrier, with a mean of 3.25.

Item 14 shows that resistance to change among developers and property owners limits the growth of smart buildings in Benin City., with a mean of 3.27. Item 15 shows that regulatory challenges and lack of supportive policies impede the adoption of smart building solutions, with a mean of 3.29.

Item 16 shows that high costs associated with smart building technologies deter investment in Benin City, with a mean of 3.14. Item 17 shows that concerns about data security and privacy prevent stakeholders from embracing smart building technologies, with a mean of 3.11.

Item 18 shows that inadequate infrastructure and connectivity issues hinder the implementation of smart technologies in Benin City, with a mean of 3.29.

Therefore, it can be categorically said that there are challenges that hinder the adoption of smart building technologies in Benin City such as limited awareness and understanding of smart building technologies among stakeholders, resistance to change among developers and property owners, regulatory challenges and lack of supportive, and high costs associated with smart building technologies.

4.3 Discussion of Findings

In determining the current state of building infrastructure in Benin City, it was discovered that the current state of building infrastructure in Benin City is quite encouraging as the building infrastructure is sufficient enough to accommodate the growing population and urban development demands and also incorporates sustainable and environmentally friendly practices. This is contradictory with the findings of

Chukwuma (2023) who stated that the state of infrastructure development in Nigeria is a mix of progress and challenges. While there have been significant investments in sectors like roads, energy, and telecommunications, the pace of development remains uneven across the country. Major cities like Lagos, Abuja, and Port Harcourt have seen improvements, particularly in transportation and housing, but rural areas still face significant infrastructure gaps. Power supply remains a critical issue, with frequent outages hindering both daily life and industrial growth. Corruption, bureaucratic inefficiencies, and inadequate funding also continue to impede the successful execution of large-scale projects, making it difficult for the country to achieve its full infrastructure potential.

Also, in assessing the key features and benefits of smart buildings in Benin City, it was discovered that smart building provide improved security measures compared to traditional buildings, enhances energy efficiency through advanced technologies, they are effectively equipped with user-friendly applications for residents' convenience, integrates IoT devices in smart buildings to improve the comfort of residents, are key features and benefits of smart buildings. This is in line with Adebayo (2023) who asserted that smart buildings are designed with advanced technologies that integrate automation, energy efficiency, and data analytics to enhance functionality and sustainability. Key features include sensors for monitoring lighting, temperature, and occupancy, as well as advanced HVAC systems and smart security measures like facial recognition or remote access control. These buildings optimize energy use, reduce operational costs, and improve occupant comfort by adjusting systems in real-time based on usage patterns. Benefits include lower energy consumption, reduced environmental impact, enhanced security, and better space utilization. Additionally,

smart buildings contribute to long-term savings through predictive maintenance and can be more easily adapted to future technological advancements.

In assessing the challenges that hinder the adoption of smart building technologies in Benin City, it was observed that that there are challenges that hinder the adoption of smart building technologies in Benin City such as limited awareness and understanding of smart building technologies among stakeholders, resistance to change among developers and property owners, regulatory challenges and lack of supportive, and high initial costs associated with smart building technologies. This is in line with Owoeye and Adeyemi (2023) who asserted that the adoption of smart building technologies faces several challenges, including high initial costs and the complexity of retrofitting older buildings with the necessary infrastructure. Many property owners or developers are hesitant to invest in smart systems due to concerns about the return on investment, particularly in markets where energy prices are low or the payback period is lengthy. Additionally, there are issues related to cybersecurity, as interconnected devices can be vulnerable to hacking or data breaches, raising concerns about privacy and safety. Lack of standardized protocols and interoperability between different systems also complicates the integration process. Moreover, there is a skills gap, with insufficient numbers of trained professionals capable of installing, maintaining, and optimizing smart building technologies. These barriers can slow the widespread adoption of smart buildings, especially in developing regions.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The summary of findings for the study is presented in this section, conclusion reached with recommendation made as regarding the prospect of smart building development in Nigeria, using Benin City as a case study.

5.2 Summary

This study investigated the prospect of smart building development in Nigeria, using Benin City as a case study. Three (3) objectives were raised for the study which are: to assess the current state of smart building infrastructure in Nigeria; to identify the key features and benefits of smart buildings in the study area; and to examine the challenges hindering the widespread adoption of smart building technologies in Nigeria. The study adopted survey research design. The instrument for data collection was a questionnaire; it was built around the research question by the researcher and validated by the researcher's supervisor. Data collected were analysed using descriptive statistics by means of frequency count, simple percentage, mean and standard deviation. The following findings from the study:

i. The current state of building infrastructure in Benin City is quite encouraging as the building infrastructure is sufficient enough to accommodate the growing population and urban development demands and also incorporates sustainable and environmentally friendly practices.

ii. Smart building provide improved security measures compared to traditional buildings, enhances energy efficiency through advanced technologies, they are effectively equipped with user-friendly applications for residents' convenience, integrates IoT devices in smart buildings to improve the comfort of residents, are key features and benefits of smart buildings.

iii. There are challenges that hinder the adoption of smart building technologies in Benin City such as limited awareness and understanding of smart building technologies among stakeholders, resistance to change among developers and property owners, regulatory challenges and lack of support and high initiallcosts associated with smart building technologies.

5.2 Conclusion

The prospect of smart building development in Nigeria, with Benin City as a case study, holds significant promise, particularly given the growing urbanization and the need for more efficient infrastructure. As a city that is increasingly expanding both in population and commercial activity, Benin City stands to benefit from the integration of smart building technologies, which can help address challenges like energy inefficiency, traffic congestion, and security concerns. Smart buildings could offer solutions such as optimized energy usage, enhanced security systems, and real-time monitoring of utilities, all of which could improve living standards and reduce the city's environmental footprint. Moreover, as Nigeria’s middle class continues to grow and urbanize, there is a rising demand for modern, tech-enabled properties, creating a ripe market for smart buildings in cities like Benin. However, the successful adoption of smart building technologies in Benin City will depend on overcoming several barriers. These include the high upfront costs of installation, the need for reliable internet and power infrastructure, and the challenge of creating awareness and training local professionals in advanced building technologies. Additionally, the pace of regulatory changes and standardization will play a crucial role in ensuring seamless integration and security of these systems. If these challenges can be addressed through public-private partnerships, government incentives, and investment in education and technology infrastructure, Benin City could become a model for smart city

development in Nigeria, paving the way for other cities to follow suit and accelerating the country's broader urban modernization.

5.3 Policy Recommendations

Based on the analysis and interpretation of the data obtained during this study, the following recommendations are made:

i. **Government Support and Policy Development**: To foster the growth of smart building technologies in Benin City, the Nigerian government should implement favorable policies and incentives that encourage investment in green and smart infrastructure. This could include tax breaks or subsidies for developers who incorporate smart building systems into their projects, as well as creating regulatory frameworks that address the standards for building automation, data privacy, and cybersecurity. Establishing clear guidelines and incentives would make it more attractive for developers and investors to commit to such high-tech projects and could help mitigate some of the initial cost concerns.

ii. **Public-Private Partnerships (PPPs) for Infrastructure Investment**: Given the high cost of implementing smart building technologies, the collaboration between the public and private sectors will be crucial. Local government bodies, alongside private developers and tech companies, can create partnerships to fund the necessary infrastructure upgrades, such as reliable power supply, internet connectivity, and advanced building materials. In Benin City, for instance, local authorities could work with private firms to install smart grid systems, energy-efficient street lighting, and other essential technologies that support smart buildings. These PPPs could help mitigate the financial burden on individual developers while boosting the city's overall infrastructure.

iii. **Capacity Building and Local Training Programs**: To ensure the sustainable growth of smart building development, there must be a focus on building local capacity. Nigeria, and Benin City in particular, should invest in training programs to develop a skilled workforce capable of designing, installing, and maintaining smart building systems. Universities and technical institutes can offer specialized courses in smart technologies, while local professionals can be trained in energy management, cybersecurity, and IoT integration. This would not only create job opportunities but also reduce dependency on foreign expertise, ensuring that the smart building sector is self-sustaining in the long term.

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APPENDIX

UNIVERSITY OF BENIN
FACULTY OF ENVIRONMENTAL SCIENCE
DEPARTMENT OF ESTATE MANAGEMENT

TOPIC: THE PROSPECT OF SMART BUILDING DEVELOPMENT IN NIGERIA, USING BENIN CITY AS A CASE STUDY

Dear Sir/Ma,

I am an undergraduate student of the above named department. As part of the requirements of my degree programme, it is required that I conduct a research on “the prospect of smart building development in Nigeria, using Benin City as a case study". Kindly answer the following questions as frankly as possible. You are required to simply tick (√) the answers of your choice. This questionnaire is strictly for academic purpose and therefore, any information given will be treated with utmost confidentiality and used for the stated purpose only.

Yours faithfully.

Ijeh Amarachi
(Researcher)

SECTION A: PERSONAL DATA

Instruction: Please kindly tick (√) in the spaces provided against each question.

1. **Gender:** Male ( ) Female ( )
2. **Marital Status:** Single ( ) Married ( ) Divorced ( ) Widowed ( )
3. **Religion Status:** Christianity ( ) Islam ( ) Others ( )
4. **Professional Status: Estate surveyors** ( ) Engineers ( ) Architect ( ) Quantity surveyors ( )
5. **Age:** 18 – 30 years ( ) 31 – 40 years ( ) 41 – 50 years ( ) 51 years and above ( )

SECTION B: In this section, please tick (√) in the appropriate box against the correct answer in your own opinion.

Research Question 1: What is the current state of smart building infrastructure in Benin City?

SA = Strongly Agree, A = Agree, D = Disagree, SD- Strongly disagree

S/N	ITEM	SA	A	D	SD
1	Most buildings in Benin city have automated systems for lighting,temperature and security				
2	Smart buildings in Benin city are integrated with renewable energy sources				
3	Buildings in Benin city are equipped with modern technology such as IoT sensors and data analytics				
4	The current smart building infrastructure in Benin City incorporates sustainable and environmentally friendly practices				
5	There is a sufficient availability of smart buildings in Benin City				
6	The smart building infrastructure in Benin City effectively accommodates the growing population and urban development demands				

Research Question 2: What are the benefits of smart buildings in Benin City?

SA = Strongly Agree, A = Agree, D = Disagree, SD- Strongly disagree

S/N	ITEM	SA	A	D	SD
7	Smart buildings provide improved security measures compared to traditional buildings in Benin City				
8	Smart buildings in Benin City enhance energy efficiency through advanced technologies				
9	Smart buildings in Benin City are effectively equipped with user-friendly applications for residents' convenience				
10	The use of smart technologies in buildings enhances the overall quality of life for residents				
11	Smart buildings in Benin city increases property value and appeal to potential buyers or renters				
12	Smart buildings promotes innovation and creativity through advanced technology and collaboration tools				

Research Question 3: What are the challenges that hinder the adoption of smart building technologies in Benin City?

SA = Strongly Agree, A = Agree, D = Disagree, SD- Strongly disagree

S/N	ITEM	SA	A	D	SD
13	Limited awareness and understanding of smart building technologies among stakeholders is a significant barrier				
14	Resistance to change among developers and property owners limits the growth of smart buildings in Benin City.				
15	Lack of government incentives or policies to support the adoption of smart technologies is a challenge.				
16	High costs of smart buildings is a major challenge in Benin city				
17	Difficulty in integrating smart buildings technology with existing management systems is a challenge in Benin city.				
18	Inadequate infrastructure and connectivity issues hinder the implementation of smart technologies in Benin City				

Thank you