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An evaluation of Architectural Science and Technology as a Core component of Architectural practice in Nigeria

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ABSTRACT

This study examines the significance of architectural science and technology as a core branch of architectural education and practice in Nigeria. As a multidisciplinary field integrating building technology, environmental performance, and human-centered design, architectural science plays a crucial role in addressing contemporary challenges in the built environment. Despite its global relevance, its application in Nigeria remains underdeveloped and insufficiently defined, particularly in the context of climate adaptation, energy efficiency, and sustainable design.

The research adopts a qualitative approach, utilizing an extensive review of academic literature, professional guidelines, and architectural curricula to evaluate the position of architectural science within the Nigerian architectural framework. Key areas explored include sustainability, building performance, environmental control systems, construction technology, and climate-responsive design.

Findings reveal that architectural science provides essential strategies for mitigating environmental challenges such as excessive heat, poor indoor air quality, and energy inefficiency through both passive and active design solutions. However, its integration into architectural education and professional practice in Nigeria is limited by factors such as inadequate research infrastructure, inconsistent curriculum implementation, low practitioner awareness, and the absence of performance-based building regulations.

The study therefore concludes that strengthening architectural science through curriculum reform, policy integration, and capacity development is critical to improving building performance and achieving sustainable development in Nigeria.

Keywords: Architectural science, Building technology, Sustainable design, Nigerian architecture, Building performance

1 INTRODUCTION

Architecture in Nigeria has traditionally emphasized aesthetics, cultural identity, and spatial organization (Lodson, Ogbeba and Elinwa, 2018). However, increasing concerns about climate change, energy consumption, and environmental sustainability have shifted attention toward performance-based and scientifically informed design approaches (Viganò, Rugani, Marengo, Picco, 2024). This shift has reinforced the importance of architectural science and technology as essential components of contemporary architectural practice.

Architectural science focuses on the application of scientific principles to building design, particularly in areas such as thermal performance, energy efficiency, indoor environmental quality, and climate responsiveness. As noted by Edward and Chau-kwong (2016), building performance and environmental design are central to achieving sustainable architecture, especially in rapidly urbanizing regions. Similarly, Emmitt (2019) emphasizes that architectural technology plays a critical role in translating design concepts into buildable, efficient, and high-performing structures through the integration of materials, construction systems, and digital tools.

In the Nigerian context, the relevance of architectural science is increasingly evident due to persistent environmental and developmental challenges. Rapid urbanization, rising temperatures, and inadequate housing conditions have resulted in buildings that often perform poorly in terms of thermal comfort and energy efficiency. Olotuah and Adedeji (2019) emphasized the need for climate-responsive design strategies, including passive cooling, natural ventilation, and appropriate material selection, to improve building performance in Nigeria. Similarly, empirical studies in international journals such as Building and Environment and Energy and Buildings have consistently demonstrated that climate -sensitive design strategies can significantly reduce cooling loads, improve indoor thermal comfort, and enhance overall energy performance in tropical climates (Chandel & Aggarwal, 2011; Nguyen *et al.,* 2014).

For example, research on naturally ventilated buildings in hot-humid regions shows that optimized building orientation, shading devices, and cross-ventilation can reduce indoor temperatures by up to 2–4° C, thereby reducing reliance on mechanical cooling systems (Toe & Kubota, 2015). These findings reinforce the applicability of architectural science principles in improving building performance under tropical conditions similar to those found in Nigeria.

Despite this growing body of knowledge, the integration of architectural science and technology into architectural education and professional practice in Nigeria remains limited. Studies have shown that while environmental design and building technology courses exist within architectural curricula, they are often taught in isolation and are not fully integrated into design decision-making processes (Olotuah, 2006; Olotuah *et al*., 2016). In addition, architectural education in institutions such as the University of Ibadan (UI), Obafemi Awolowo University (OAU), and Federal University of Technology Akure (FUTA) continues to reflect a strong studio-based tradition with limited emphasis on performance-based design and simulation-driven approaches (Adedeji *et al.,* 2011). This gap is further reinforced by weak curriculum implementation, inadequate research infrastructure, and the absence of enforceable performance-based building standards in practice.

Nevertheless, recent advancements in sustainable design approaches and the increasing adoption of digital tools such as Building Information Modelling (BIM) indicate a gradual transition toward more evidence-based architectural practice in Nigeria (Eastman et al., 2018).This study examines the significance of architectural science and technology as a core branch of architecture, which is yet to be given significant attention in architecture curriculum and literature in Nigeria. It also evaluates its main areas of focus and considers how it can contribute to addressing climate change, energy, and urban development challenges in the country.

2 LITERATURE REVIEW

A systematic and purposive review of literature was undertaken to examine architectural science and technology within architectural discourse, with emphasis on relevance to Nigeria and similar developing contexts. The review included peer-reviewed journal articles, books, and technical reports published between 2015 and 2025, with priority given to foundational and recent studies that address building performance, sustainability, environmental design, and technological integration in architecture. The purpose was not only to identify key themes but also to critically evaluate the extent to which architectural science is embedded in both theory and practiceA critical synthesis of literature reveals that architectural science and technology are increasingly recognised as essential to achieving sustainable, high-performing buildings. Rather than being treated as supplementary tools, contemporary scholarship positions them as integral to architectural decision-making, particularly in relation to environmental performance, materials selection, and digital design processes (Szokolay, 2014; Kibert, 2016).

A major and consistent theme is environmental and building performance, which focuses on how buildings respond to climate, users, and energy demands. Szokolay (2014) argues that in tropical climates, architectural design must prioritise passive strategies such as shading, ventilation, and orientation to achieve thermal comfort without excessive reliance on mechanical systems. Supporting this, De Wilde (2018) emphasises that building performance analysis requires a multidisciplinary approach combining environmental physics, occupant behaviour, and simulation-based evaluation. However, despite strong theoretical frameworks, empirical studies suggest that performance-based design remains underutilised in practice, especially in developing contexts where design decisions are often guided by cost and aesthetics rather than scientific analysis.

In the Nigerian context, Olotuah and Adedeji (2019) observe that many residential buildings fail to achieve adequate thermal comfort due to poor environmental design and limited application of passive strategies. Similarly, Ibem et al. (2013) highlight persistent deficiencies in housing quality, particularly in urban areas, where inadequate planning and poor construction practices compromise environmental performance. These studies collectively indicate a gap between established architectural science principles and actual building outcomes in Nigeria.

Another key theme is sustainable materials and construction technology. Kibert (2016) emphasises that sustainable construction requires lifecycle thinking in material selection, focusing on energy efficiency, durability, and environmental impact. However, studies in developing contexts reveal continued dependence on conventional materials due to cost constraints and limited technical capacity. Nigerian-based studies such as Uji (2017) and Adeyemi (2018) note that while awareness of sustainable materials is increasing, adoption remains limited, particularly in mainstream construction practice.

The literature also highlights the growing role of digital technologies and Building Information Modelling (BIM) in enhancing architectural science. Eastman et al. (2018) demonstrate that BIM improves design coordination, performance prediction, and lifecycle management of buildings. Similarly, Ng (2010) notes that simulation tools enable early-stage evaluation of energy performance, daylighting, and environmental impact. However, Oyedele et al. (2015) report that BIM adoption in developing countries, including Nigeria, is constrained by high software costs, limited expertise, and weak institutional support, resulting in slow integration into professional practice.

Across these themes, architectural science emerges as a multidisciplinary field that integrates environmental design, structural logic, material science, and digital technologies. While its theoretical importance is well established globally, its application in developing contexts such as Nigeria remains inconsistent, revealing a persistent gap between knowledge and implementation.

Gaps identified in the Literature

Despite extensive global and regional scholarship, several critical gaps remain. First, while architectural science is well documented in theory, there is limited context-specific research examining its integration within architectural education in Nigeria. Second, most Nigerian studies focus on isolated issues such as housing quality, sustainability, or materials, with little integration across curriculum, education, and professional practice. Third, there is a lack of empirical studies that directly connect architectural curricula to observed deficiencies in professional architectural outcomes.

Furthermore, existing literature rarely investigates whether the limited application of architectural science in practice is rooted in educational structure or professional constraints. This gap is particularly significant, as it raises questions about whether architectural curricula sufficiently prepare graduates for performance-based and technology-driven practice.

These gaps justify the present study, which evaluates architectural science and technology as a core component of architectural practice in Nigeria, with emphasis on both educational structure and professional application. Although the reviewed literature provides valuable insights into architectural science and technology, it is largely based on secondary and published sources, with limited representation of context-specific empirical studies from Nigeria. This highlights the need for further investigation into how these principles are reflected in architectural education and professional practice within the Nigerian context.

3 RESEARCH METHODOLOGY

This study adopts a qualitative research approach based on a systematic literature review to examine the scope and significance of architectural science and technology as a core component of architectural practice in Nigeria. The qualitative approach is appropriate as it allows for an in-depth exploration of concepts, identification of key themes, and critical analysis of the integration of architectural science within both education and practice.

In addition to the literature review, a targeted curriculum review was conducted to complement the study. This involved examining architectural programme structures and course outlines from selected universities in South-West Nigeria, namely Federal University of Technology Akure, University of Ibadan, and Obafemi Awolowo University. These institutions were selected through purposive sampling based on the maturity of their architecture programmes, academic reputation, and availability of curriculum information, making them suitable for providing indicative insights into architectural education in the region.

The curriculum review focused on identifying the presence, depth, and level of integration of architectural science-related courses such as building construction, environmental control systems, building services, structural systems, and digital design tools. Particular attention was given to the balance between design studio courses and technical/scientific courses, as well as the extent to which scientific principles are integrated into design studio teaching. Data obtained from both literature and curriculum sources were analyzed thematically to identify recurring patterns, gaps, and trends relating to architectural science and technology. This enabled a comparative and interpretive assessment of how architectural education influences professional practice in Nigeria.

4 Findings and Discussion

4.1 Scope and Core Areas of Architectural Science and Technology

Architectural science and technology encompass the technical, environmental, and performance-oriented aspects of the built environment that directly influence how buildings function, perform, and respond to climate and user needs. At its core, architectural science extends beyond form-making to integrate building physics, environmental control, material science, and sustainability principles, all of which are critical in designing buildings that are efficient, comfortable, and resilient in diverse climatic conditions.

A central domain within architectural science is *environmental and building performance*, which involves understanding how design decisions affect thermal comfort, natural ventilation, day lighting, indoor air quality (IAQ), and overall energy performance. Recent research underscores the importance of optimizing thermal performance and energy efficiency to reduce operational loads and improve occupant comfort, particularly in warm and tropical climates where environmental stressors are significant (Zhao, Ma & Zhang, 2025). In the Nigerian context, passive design strategies such as building orientation and shading have been shown to improve thermal comfort and reduce energy use in specific building types, demonstrating how environmental design can be effective when informed by local climatic data (Egwabor, Alokun & Olodeoku, 2024).

Another essential area is *building materials and construction technology*, which examines how materials' properties including thermal conductivity, insulation characteristics, and life cycle impacts contribute to energy performance. Recent reviews of advanced, energy-efficient materials highlight their contributions to reducing heat transfer and environmental impacts while supporting overall sustainability goals (Bal & Rani, 2025).

Sustainable design and environmental systems integrate ecological and renewable energy principles into architectural practice. Studies show that passive solar design, natural ventilation, and other climate-responsive strategies significantly reduce energy consumption in buildings in tropical regions (Kalu, Ogunnaike & Eze, 2025). These strategies align with global findings showing that building adaptation to climate change requires both passive and active solutions to support comfort and reduce emissions (Tajuddeen & Sajjadian, 2024). Digital tools and *building informatics* are increasingly central to architectural science, with modelling and simulation enabling evidence-based design decisions. Though specific global studies emphasize building performance assessment methods, including dynamic thermal modelling and monitoring, such tools provide designers with capabilities to predict performance outcomes and optimize energy use (Seminara et al., 2022). *Empirical research and performance evaluation* are equally important, as post-occupancy evaluation and performance monitoring help validate design decisions, reveal gaps between predicted and actual performance, and inform future improvements.

Collectively, these core areas illustrate how architectural science and technology interconnect across design, materials, systems, and performance evaluation to support high-performing, sustainable, and contextually responsive architecture. Their integration is critical for addressing contemporary environmental challenges and improving the quality and resilience of buildings in regions such as Nigeria.

4.2 Discussion on core areas of Architectural Science and Technology

4.2.1 Environmental and Building Performance

Environmental and building performance refer to the ability of a building to effectively meet its functional, environmental, and user-related objectives throughout its lifecycle. This includes key aspects such as thermal comfort, energy efficiency, indoor environmental quality, durability, and user satisfaction. Building performance is inherently multidisciplinary, integrating principles from engineering, building physics, environmental psychology, and simulation-based design (De Wilde, 2018; Szokolay, 2014).

The fundamental purpose of any building is to provide a safe, healthy, and comfortable environment that supports human activities. Studies have shown that buildings must respond appropriately to climatic conditions while ensuring occupant well-being and operational efficiency (Ibem, Opoko, Adeboye, & Amole, 2013; Gopikrishnan & Topkar, 2017). In this regard, building performance is often assessed based on how well indoor conditions are maintained in relation to external environmental stressors.

In tropical regions such as Nigeria, environmental performance is particularly critical due to high temperatures, humidity, and solar radiation. Poorly designed buildings often result in thermal discomfort and increased reliance on mechanical cooling systems, thereby raising energy consumption. Passive design strategies—including proper orientation, shading devices, and natural ventilation—have been widely identified as effective approaches to improving thermal performance and reducing energy demand (Olotuah & Adedeji, 2019).

Post-occupancy evaluation (POE) is a key method for assessing building performance after occupation. It provides insights into how buildings function in real-life conditions, helping to identify gaps between design intentions and actual performance. POE contributes to improved design practices by incorporating user feedback and operational data into future projects (Preiser & Vischer, 2005). However, its application in Nigeria remains limited, contributing to persistent performance challenges in the built environment.

4.2.2 Building Materials and Construction Technology

Building materials and construction technology play a fundamental role in determining the performance, durability, and sustainability of buildings. This domain focuses on the properties, behavior, and application of materials, as well as the methods and technologies used in construction. The selection of appropriate materials directly influences structural stability, thermal performance, environmental impact, and lifecycle cost (Kibert, 2016). Recent advancements in material science have led to increased interest in sustainable and innovative building materials. These include recycled materials, low-carbon concrete, and locally sourced alternatives such as earth-based construction materials. Such materials contribute to reduced environmental impact while improving energy efficiency and affordability, particularly in developing countries (Kibert, 2016).

In addition to material innovation, construction technologies have evolved significantly, enhancing efficiency and quality in building delivery. Techniques such as prefabrication and modular construction reduce material waste, improve construction speed, and ensure better quality control. Furthermore, digital tools such as Building Information Modelling (BIM) enable integrated project planning, accurate visualization, and improved coordination among stakeholders (Eastman, Teicholz, Sacks, & Liston, 2018).

Despite these advancements, the adoption of modern construction technologies in Nigeria remains relatively low. Challenges such as high initial costs, limited technical expertise, and inadequate infrastructure hinder widespread implementation. Nevertheless, the integration of sustainable materials and advanced construction technologies remains essential for improving building performance and achieving long-term environmental sustainability.

4.2.3 Sustainable Design and Environmental Systems

Sustainable design and environmental systems involve the integration of ecological principles and energy-efficient strategies into the planning, design, construction, and operation of buildings. The objective is to minimize environmental impact while enhancing occupant comfort, resource efficiency, and long-term resilience (Edwards, 2014). A key component of sustainable design is the use of passive strategies, such as solar orientation, natural ventilation, thermal mass, and shading devices, to regulate indoor environmental conditions. These approaches are particularly effective in tropical climates, where they can significantly reduce dependence on mechanical systems. Active systems, including renewable energy technologies, efficient lighting systems, and water conservation measures, further enhance building sustainability.

Globally, sustainable building practices are supported by rating systems such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM), which provide frameworks for assessing environmental performance (Kibert, 2016). However, the adoption of such systems in developing countries, including Nigeria, is still emerging due to economic and institutional constraints.

The integration of environmental systems within architectural design requires collaboration between architects, engineers, and other stakeholders. This interdisciplinary approach ensures that buildings are not only environmentally responsible but also functional and user-centered. As sustainability becomes a global priority, the role of architectural science in promoting environmentally responsive design continues to grow.

4.2.4 Structural Systems

Structural systems form the backbone of architectural design, ensuring the stability, reliability, strength, and safety of buildings. They consist of interconnected elements such as beams, columns, slabs, walls, and foundations that transfer loads safely to the ground. Structural design is therefore a critical aspect of architectural science, as it directly influences building performance and durability (Ching & Onouye, 2012).

Beyond ensuring safety, structural systems also play a significant role in shaping architectural form and spatial organization. The integration of structure with design intent allows architects to achieve both functional and aesthetic objectives. Modern structural design increasingly incorporates advanced materials and computational tools, enabling more efficient and innovative solutions.

In Nigeria, structural performance has become a major concern due to the increasing incidence of building failures and collapses. These challenges highlight the need for improved structural design practices, stricter regulatory enforcement, and better collaboration between architects and engineers. The adoption of modern structural technologies and adherence to established standards are essential for enhancing safety and resilience in the built environment.

4.2.5 Environmental Control Systems and Human Factors

Environmental control systems (ECS) are responsible for regulating indoor environmental conditions, including temperature, air quality, lighting, and acoustics. These systems are essential for maintaining occupant comfort, health, and productivity, particularly in urban environments where external conditions may be unfavorable (Szokolay, 2014). Mechanical systems such as heating, ventilation, and air conditioning (HVAC), as well as artificial lighting and building automation systems, play a key role in achieving desired indoor conditions. However, excessive reliance on mechanical systems can lead to increased energy consumption. Therefore, integrating passive design strategies with efficient environmental control systems is crucial for achieving sustainable building performance.

Human factors and ergonomics focus on the relationship between occupants and the built environment. This includes considerations such as spatial layout, accessibility, safety, and psychological comfort. Designing with human factors in mind ensures that buildings are functional, inclusive, and responsive to users' needs (Steinfeld & Maisel, 2012).Ergonomic principles emphasize the importance of designing spaces that accommodate human dimensions, capabilities, and limitations. This includes aspects such as circulation patterns, furniture design, lighting quality, and acoustic comfort. Incorporating these considerations into architectural design enhances user satisfaction, productivity, and overall well-being.

4.3 Application of Architectural Science and Technologyin Nigerian Architecture

Architectural science and technology form the backbone of performance-driven, sustainable architecture worldwide. In the Nigerian context, their application is central to addressing the country's climatic diversity, urbanization challenges, resource limitations and the pressing need for healthful, resilient and cost-effective buildings. While architecture is often seen through the lens of artistic expression, it is fundamentally rooted in scientific principles, environmental performance and technological innovation, making architectural science a core and indispensable component of modern Nigerian architectural practice (Szokolay, 2014; Olusanya, 2022). Its area of application in the context of Nigerian architecture are itemized below:

4.3.1 Climate-Responsive Design

Nigeria's diverse climatic zones ranging from humid tropical conditions in the south to hot-dry environments in the north necessitate context-specific architectural responses. Architectural science provides a systematic framework for climate-responsive design by integrating principles of thermal comfort, solar geometry, natural ventilation, and building physics into design

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decisions. Passive strategies such as optimized building orientation, shading devices, thermal mass utilization, and courtyard configurations are essential in reducing heat gain and minimizing dependence on mechanical cooling systems (Szokolay, 2014; Olotuah & Adedeji, 2019).

Traditional architecture in Northern Nigeria illustrates early applications of climate-responsive design, where thick adobe walls, small window openings, and internal courtyards regulate indoor temperatures. Contemporary architectural science validates these strategies through simulation tools and environmental modelling, enabling their refinement and adaptation to modern construction systems. This integration of indigenous knowledge with scientific analysis enhances both environmental performance and cultural relevance.

4.3.2 Integration of Building Performance Modelling (BPM)

The adoption of Building Performance Modelling (BPM) represents a significant advancement in architectural practice, shifting design processes from intuition-based approaches to data-driven decision-making. Through simulation tools, architects can evaluate key performance indicators such as energy consumption, daylight availability, airflow dynamics, and thermal comfort at the design stage. This predictive capability improves design efficiency, reduces operational costs, and enhances overall building performance (Eastman *et al.,* 2018).

In Nigeria, the integration of tools such as Building Information Modelling (BIM) and environmental simulation software is gradually increasing within academic and professional practice. However, adoption remains limited due to constraints including high software costs, inadequate technical expertise, and limited institutional support. Addressing these challenges is critical to fully realizing the potential of performance-based design in the Nigerian built environment.

4.3.3 Sustainable Material Innovation

Material selection is a fundamental aspect of architectural science, as it directly influences structural performance, environmental impact, and lifecycle cost of buildings. In Nigeria, the application of architectural science has led to increased interest in sustainable and locally sourced materials such as laterite, compressed earth blocks, bamboo, and agricultural by-products. These materials are being evaluated using scientific methods to determine their thermal properties, durability, and environmental performance (Kibert, 2016).

The use of such materials reduces dependence on energy-intensive imported products while lowering construction costs and carbon emissions. Furthermore, the scientific validation of traditional materials supports their integration into modern architectural practice, fostering a balance between sustainability, cultural identity, and technological advancement.

4.3.4 Indoor Environmental Quality (IEQ) and Health

Indoor Environmental Quality (IEQ) is a critical determinant of occupant health, comfort, and productivity, encompassing thermal conditions, air quality, lighting, and acoustics. In many Nigerian urban environments, buildings often suffer from poor ventilation, inadequate natural lighting, and excessive heat gain, resulting in thermal discomfort and increased health risks. Studies have shown that inadequate ventilation in residential and institutional buildings in cities such as Lagos and Ibadan contributes to poor indoor air quality and the accumulation of pollutants, which can lead to respiratory issues and symptoms associated with sick building syndrome (Adebayo, 2014; Akinbami, 2012). Similarly, research on educational buildings in southwestern Nigeria highlights challenges related to overheating and poor daylighting, which negatively affect occupants' comfort and productivity (Olgyay, 2015; Ojo & Adebayo, 2017). In addition, the reliance on artificial cooling systems due to poor passive design strategies further exacerbates energy consumption and indoor environmental inefficiencies (UN-Habitat, 2020). These conditions underscore the need for improved design approaches that prioritise ventilation, daylight optimisation, and thermal control in Nigerian buildings.

4.3.5 Disaster Resilience and Climate Adaptation

The increasing frequency of climate-related events such as flooding, heatwaves, and erosion has heightened the need for resilient architectural solutions in Nigeria. Architectural science plays a vital role in disaster risk reduction by integrating environmental analysis, structural design, and climate adaptation strategies into building design.

Approaches such as elevated structures in flood-prone areas, improved drainage systems, and climate-sensitive urban planning enhance the resilience of buildings and communities. The application of these strategies, supported by environmental data and modelling tools, enables architects to design buildings that are adaptable to changing climatic conditions and capable of minimizing environmental risks (UN-Habitat, 2022).

4.3.6 Architectural Education and Research Integration

Architectural education in Nigeria incorporates key components of architectural science, including building physics, environmental design, construction technology, and building services; however, as evidenced by curriculum review in selected South-West Universities , the depth and integration of these components remain unlimited.

However, the translation of theoretical knowledge into practical application remains limited. Challenges such as inadequate research infrastructure, limited access to advanced technologies, and weak collaboration between academia and industry hinder innovation. Strengthening research capacity, promoting interdisciplinary collaboration, and integrating digital design tools into curricula are essential for advancing architectural science in Nigeria (Adeyemi & Oluwatayo, 2022).

4.3.7 Digital Transformation and Smart Technologies

Digital technologies are increasingly reshaping architectural practice, with tools such as Building Information Modelling (BIM), smart building systems, and Internet of Things (IoT) enabling more efficient and responsive building design and management. These technologies support real-time monitoring of building performance, predictive maintenance, and optimized energy use, thereby improving operational efficiency and sustainability (Eastman *et al*., 2018).

In Nigeria, the adoption of smart technologies is still emerging, largely constrained by infrastructural and economic limitations. Nevertheless, their potential to transform the built environment is significant, particularly in addressing challenges related to energy efficiency, building management, and urban development. As digital adoption increases, architectural science will play a central role in driving innovation and improving building performance across the country.

4.4 Review of Architectural Curriculum in Selected South-West Nigerian Universities

To further investigate the underlying factors contributing to the limited integration of architectural science and technology in professional practice, a review of architectural curricula in selected universities in South-West Nigeria was conducted. The institutions examined include Federal University of Technology Akure, University of Ibadan, and Obafemi Awolowo University, all of which have well-established architectural programs. The review assessed the presence, depth, and level of integration of architectural science courses within the broader structure of architectural education.

The findings indicate that architectural science-related courses—such as building construction, environmental control systems, building services, and materials science are consistently present across the curricula of the institutions reviewed. However, a comparative assessment reveals a common pattern in which these courses are treated primarily as supporting or complementary subjects rather than as core components driving the design process. Architectural design studio courses dominate the curriculum in terms of credit allocation and instructional emphasis, often spanning all levels of study, while architectural science courses are typically confined to specific semesters and delivered as standalone theoretical modules.

Furthermore, the depth of engagement with architectural science remains relatively limited, with minimal continuity across successive levels of training. More critically, there is weak integration between scientific knowledge and studio-based design activities, thereby restricting opportunities for students to apply performance-based principles in practical design scenarios. Advanced aspects of architectural science, including building performance simulation, environmental modelling, and data-driven design tools, receive little emphasis and are in some cases absent, limiting students' exposure to contemporary, evidence-based design methodologies.

Overall, the curriculum review demonstrates that while architectural science is formally included in architectural education within South-West Nigeria, it is not sufficiently embedded as a central and integrative element of the design process. This imbalance characterized by limited depth, fragmented structure, and weak application contributes significantly to the gap observed in professional practice, where architectural decisions are often not fully informed by scientific analysis and technological capabilities

5 Conclusion

This study has examined the significance and scope of architectural science and technology as a fundamental and evolving branch within architectural practice in Nigeria. It has demonstrated that architectural science extends beyond theoretical constructs to provide practical, evidence-based solutions for addressing contemporary challenges in the built environment. Within the context of rapid urbanization, climate variability, energy constraints, and public health concerns, the findings affirm that architectural science plays a critical role in shaping sustainable, functional, and human-centered design outcomes.

The study highlights that architectural science encompasses a wide range of interrelated domains, including environmental control systems, building physics, thermal comfort, lighting and acoustics, material technology, and human factors and ergonomics. These components collectively enable a transition from purely aesthetic considerations toward performance-oriented and climate-responsive design approaches. The integration of scientific principles and technological tools—such as building performance simulation, post-occupancy evaluation, and sustainable material analysis—provides architects with the capacity to improve building efficiency, occupant well-being, and long-term economic viability.

Despite its importance, the study reveals that architectural science remains insufficiently integrated into architectural education, professional practice, and regulatory frameworks in Nigeria. Constraints such as limited curriculum depth, inadequate research infrastructure, fragmented professional knowledge, and weak policy enforcement continue to hinder its full adoption. Furthermore, the country's diverse climatic and geographical conditions underscore the need for region-specific, data-driven design solutions that incorporate both scientific analysis and indigenous knowledge systems.

Nevertheless, the growing demand for climate-resilient infrastructure, energy-efficient buildings, and user-centered environments presents a significant opportunity for advancing architectural science in Nigeria. As global architectural practice increasingly shifts toward sustainability, digitalization, and performance-based design, there is a clear imperative for Nigeria to reposition architectural science as a core academic, professional, and developmental framework. With sustained commitment to research, education, and policy integration, architectural science can serve as a catalyst for innovation and a foundation for a new generation of architects capable of addressing complex 21st-century challenges with scientific rigor and contextual sensitivity.

6 Recommendations

Strengthening the integration of architectural science and technology in Nigeria requires a coordinated approach across education, practice, and policy. Architectural curricula in institutions such as the University of Ibadan (UI), Obafemi Awolowo University (OAU), and the Federal University of Technology Akure (FUTA) should be reviewed and harmonised to position architectural science as a core component rather than a supporting subject. Key areas such as building physics, environmental control systems, materials science, lighting, acoustics, human factors, and building performance evaluation should be embedded within design studio teaching to encourage practical application.

A shift toward performance-based and technology-driven learning is necessary. The integration of environmental simulation tools and Building Information Modelling (BIM) into academic programmes will help bridge the gap between theory and practice, while stronger collaboration between architecture, engineering, and environmental science disciplines will promote a more holistic understanding of building performance.

Investment in research infrastructure is essential to support innovation and evidence-based practice. The provision of well-equipped laboratories, simulation centres, and material testing facilities will enhance research in areas such as thermal comfort, indoor environmental quality, energy performance, and sustainable materials.

Architectural science principles should also be reflected in national building regulations and urban development policies. The Nigerian Building Code needs to incorporate clear performance-based standards addressing energy efficiency, thermal comfort, sustainability, and occupant health, alongside context-specific evaluation tools suited to Nigeria's climatic diversity and stronger enforcement mechanisms.

Continuous professional development should be prioritised to keep practicing architects aligned with emerging technologies and evolving design approaches. Training programmes, workshops, and certification initiatives in BIM, environmental simulation, smart systems, and sustainable design will strengthen professional competence.

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