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# Artificial Intelligence in Facilities Management: Theories, Barriers, and Pathways for Adoption in Nigerian Universities

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**Abstract**

The increasing recognition and acceptance of Artificial Intelligence (AI) as an important transformative force in Facilities Management (FM), underscores its spreading applications ranging from predictive maintenance and energy optimization to space utilization and security. Globally, Al-application in FM practices have delivered measurable benefits. However, its adoption in Nigeria-particularly within universities-remains limited and fragmented. This paper presents a comprehensive review of AI integration in FM. it synthesizes theoretical, empirical, and contextual insights to assess probable adoption barriers and opportunities in the Nigerian tertiary education sector. This work is anchored on the following theoretical frameworks-Unified Theory of Acceptance and Use of Technology (UTAUT), Technology Acceptance Model (TAM), Diffusion of Innovations Theory, and Systems Theory. These frameworks are applied to synthesize the linkage between adoption, utilization, and maintenance as constructs shaping user satisfaction and long-term sustainability. Evidence from Nigerian illustrates both the potential and fragility of current initiatives. Major barriers identified include inadequate infrastructure, high costs, weak data systems, skills shortages, and limited policy frameworks. Other concerns include but not limited to ethical and social concerns. The paper argues for a robust strategy involving the combination of infrastructure investment, professional capacity building, policy reforms, government-backed pilot projects, and ethical safeguards to create an enabling environment for AI-driven FM. The review concludes that while Nigeria's FM sector faces formidable challenges, AI presents a viable pathway for addressing systemic inefficiencies and enhancing sustainability in universities. With coordinated reforms and context-sensitive strategies, AI can evolve from isolated pilots into a cornerstone of modern facilities management in Nigerian higher education.

**Keywords:** Artificial Intelligence, Facilities Management, Nigerian Universities,UTAUTAdoption,Utilization,Maintenance,Barriers,Sustainability.



## INTRODUCTION

The global facilities management (FM) industry is undergoing a rapid and significant transformation,driven by the convergence of digital technologies and increasing demands for efficiency,sustainability, and user satisfaction. Among these innovations, Artificial Intelligence(AI)stands out as a change agent with the potential ofrevolutionizing how buildings and infrastructure are managed. AI encompasses a range of technologies-including machine learning, natural language processing, computer vision, and robotics-that enable systems to mimic human cognitive functions such as learning, reasoning, and decision-making

(Salehi &Burgueño, 2018). Within FM, AI can provide opportunities such as shift from reactive, manual approaches to proactive, data-driven management strategies that enhance asset performance,reduce lifecycle costs, and improve user experience (Pollock, 2024; Wong et al., 2018).

Universities, hospitals, and corporate estates are already leveraging AI to optimize energy management, automate maintenance, improve security, and streamline space utilization (Liao et al., 2020; Lee et al., 2021). For instance, predictive analytics applied to heating,ventilation, and air-conditioning (HVAC) systems have been shown to reduce downtime and cut energy costs by up to 20% in advanced economies (Elmualim et al., 2010). Similarly,AI-enabled surveillance and anomaly detection systems improve campus safety while reducing reliance on manual monitoring. These examples demonstrate AI's potential as a transformative enabler of sustainable and efficient FM systems.

However,in Sub-Saharan Africa-and Nigeria in particular-FM practice remains at an early stage of digital transformation. Nigerian universities face mounting pressures due to aging infrastructure, growing student populations, and chronic underfunding (Adegbile et al., 2021).While some institutions have piloted AI-driven initiatives, such as smart metering at the University of Lagos and automated water management systems in Enugu State (Akinyemi &Adebayo, 2021; Chukwuma et al.,2022),adoption remains sporadic and uneven. Challenges such as erratic power supply, weak digital infrastructure, and a significant skills gap among FM professionals have slowed progress (Odediran et al., 2015;Ogunleye,2021).

This paper applies three theoretical lenses-Technology Acceptance Model (TAM),Diffusion of Innovations Theory (DOI), and Systems Theory-to analyze AI adoption in Nigerian FM.Together, these frameworks provide a comprehensive understanding of how individual perceptions, organizational dynamics, and systemic interconnections shape the prospects for AI integration in higher education facilities management. By situating Nigerian realities within global trends, this work highlights both challenges and opportunities for leveraging AI to modernize FM and promote efficiency and sustainable development in the country's higher education sector.

**Theoretical Framework2.1 Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM), developed by Davis (1989), is one of the most widely used frameworks for examining the level of technology adoption by individuals. Ithas two core constructs-Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). These two constructs explain how users'attitudes and their intentions toward technology ultimately influence their actual use behavior. In the context of AI adoption in FM, TAM highlights the psychological and behavioral factors shaping facility managers' willingness to embrace digital tools.

In Nigerian universities, performance expectancy (a variant of perceived usefulness) contends with the belief that AI will enhance FM outcomes by improving operational efficiency,predictive maintenance, cost reduction, and user satisfaction. For instance, an Al-enabled predictive maintenance system could mitigate unplanned breakdowns of equipment, extending asset life and boosting property values. Similarly, effort expectancy (perceived ease of use) indicates whether FM professionals find AI systems user-friendly and, accessible.Dashboards with visual analytics, mobile alerts, and automated reporting can lower barriers for FM professionals who may lack advanced technical expertise (Adam et al., 2021).

Social influence is another crucial determinant. According to Ezeokoli et al. (2021), the

Nigerian FM managers are more likely toadopt Al if peers in other universities demonstrate success, or if institutional leadership actively champions innovation. Equally important are facilitating conditions-reliable electricity, internet connectivity, funding, and ICT support-which determine the extent or level of adoption of AI tools beyond intention to sustained use. Without these enablers, even enthusiastic managers cannot sustainably deploy AI tools in facility management practice.

Comparative evidence underscores TAM's contextual relevance. In the UK, Adam et al.

(2021)found that perceived usefulness was the dominant driver of AI adoption in FM, with 78% of surveyed professionals citing efficiency gains. However, in Nigeria, Ezeokoli et al. (2021)revealed that 65% of FM professionals considered AItoo complexdueto low digital literacy and infrastructural constraints. This divergence suggests that TAM'sconstructs are universally applicable but are heavily shaped by local conditions. Moreover, Nigerian universities often operate under resource-constrained environments where organizational factors-such as budget priorities and leadership commitment-may override individual willingness to adopt new technologies (Odediran et al., 2015). Thus, while TAM provides valuable insights into user perceptions, its explanatory power must be supplemented with broader organizational and systemic perspectives to capture the full picture of AI adoption in Nigeria.

**Diffusion of Innovations Theory (DOI)**

The Diffusion of Innovations Theory, articulated by Rogers (2003), shifts the focus from individual perceptions to the social processes by which new technologies spread within organizations and societies. DOI is a concept that emphasizes five innovation attributes that influence adoption:relative advantage, compatibility, complexity, trialability, and observability.Empirical evidence from earlier studies suggests that these attributes are highly relevant in the Nigerian FM context.Mobayo et al. (2021) found that FM professionals in Lagos viewed relative advantage,particularly energy savings and cost reductions, as a strong motivator for AI adoption, with 70%of respondents endorsing this benefit. However, complexity-linked to lack of technical expertise-was cited by 60% as a key barrier, while compatibility issues arose from entrenched reliance on manual processes. On their part, Wong et al. (2018) demonstrated that trialability and observability accelerate adoption in developed markets globally, where pilot projects showcase AI's tangible benefits before full-scale rollout. In Nigeria, however, the scarcity of pilot projects undermines visibility and reduces institutional willingnessto embrace the commitment of AI in FM

Applying DOI to Nigerian FM highlights several strategic priorities. First,trialability must be enhanced through public - or donor-backed pilot projects in universities, which are aimed at demonstrating value at small scale before full scale implementation. Second, observability can be amply showcased by publishing case studies, exhibiting cost savings, and creating peer-to-peer platforms for FM practitioners. Third, compatibility should be propagated and amplified through hybrid models that integrate AI with existing manual practices, easing the transition for staff with limited digital literacy.

Ultimately, DOI underscores the importance of incremental and context-sensitive diffusion strategies. In Nigerian FM, this means starting with small-scale pilots, scaling through documented successes, and embedding AI gradually into institutional routines. Such an approach balances innovation with the realities of limited infrastructure, funding constraints, and resistance to change, making diffusion more sustainable over time.

**Systems Theory**

While TAM and DOI focus on adoption at the individual and organizational levels,Systems Theory provides a holistic framework for analyzing FM as a complex, interdependentnetwork of subsystems. FM encompasses multiple domains-maintenance, energy management,security,and space utilization-that interact dynamically. Systems Theory posits that improvements in one subsystem, facilitated by AI, can create positive spillovers across others, leading to systemic efficiency gains (Atkin &Bildsten, 2017).For example, in Sweden, integrated Al-driven systems reduced energy consumption and maintenance costs by 15% across 20 commercial buildings by synchronizing occupancy sensors with energy controls. In Nigeria, similar systemic gains could be realized if AI platforms coordinated maintenance schedules with energy usage patterns in university campuses.However,such integration remains rare: Babatunde et al. (2016) observed that only 15% of Nigerian public facilities used integrated FM systems, largely due to poor digital infrastructure. As a result,FM operations in Nigerian universities remain fragmented, limiting AI's ability to generate synergistic benefits.

Systems Theory also emphasizes feedback loops-the ability to use real-time data from occupants and infrastructure to continuously refine operations. In Nigeria, this could address persistent issues of low user satisfaction in university hostels and laboratories (Oseni et al.,2018). Yet, realizing such feedback loops requires robust data collection andICT infrastructureboth of which remain underdeveloped (Okoro &Osunde, 2022). Without these foundational systems,AI adoption risks remain high and piecemeal rather than transformative.

The system theory perspective reveals broader implications for Nigeria. If infrastructural and organizational barriers remain unaddressed, Nigerian universities risk widening the gap with global peers who are already leveraging Al for sustainability and cost efficiency.Whileinstitutions in the UK report energy savings of up to 20% through AI (Elmualim et al., 2010),Nigerian institutions may face escalating operational costs and deteriorating assetsif systemic integration is neglected. Thus, Systems Theory underscores that AI adoption in Nigerian FM cannot be isolated; it must be embedded within a broader organizationaltransformation that aligns infrastructure, policy, and human resources toward shared efficiency and sustainability goals.

## Facilities Management in Nigeria: Evolution,Current State, and Emerging AI Applications

### HistoricalEvolution of Facilities Management in Nigeria

Facilities Management (FM) as a discipline in Nigeria has undergone a gradual evolution shaped by colonial legacies, oil-driven expansion, and contemporary pressures of urbanization. The origins of FM in Nigeria can be traced to the British colonial administration, which prioritized basic upkeep of public infrastructure through the Public Works Department (PWD). Adekeye (2008) notes that this era was characterized by a maintenance-first orientation, where the focus was on ensuring the functionality of public buildings, roads, and utilities without significant attention to long-term strategic planning.

Following Nigeria's independence in 1960, FM practices expanded in scale due to rapid infrastructural development during the oil boom of the 1970s. Universities, government institutions, and commercial centers were built to accommodate the growing economy and population. However, the collapse of oil prices in the 1980s exposed systemic weaknesses,particularly in the underfunding and mismanagement of public infrastructure (Odediran et al.,2015). With limited budgets, the PWD's reactive maintenance culture persisted, resulting in widespread deterioration of public assets-a

challenge that continues today.

By the 2000s, globalization and urbanization brought renewed attention to FM as a professional field. Koleosoet al.(2013) observed that FM in commercial real estate,especially in Lagos,begantofocus onvalue retention, tenant satisfaction, and cost optimization. However,public institutions such as universities lagged behind, remaining entrenched in reactive maintenance and fragmented service delivery. This historical trajectory underscores the uneven developmentof FM in Nigeria, where private sector institutions adopt modern practices more quickly than public universities constrained by bureaucracy, corruption and funding deficits.3.2 Current State of Facilities Management in NigerianUniversities

Today, FM in Nigerian universities is characterized by resource constraints, infrastructural decay,and limited technological adoption.Odediran et al. (2015) highlighted that facilities in public universities-including laboratories, lecture halls, and student hostels-suffer from neglect due to chronic underfunding. On average, FM budgets in Nigerian public universities account for only 5% of institutional expenditures, far below the international benchmark of 10-15% recommended by IFMA (2020).

The FM workforce is youthful, with most professionals drawn from related built environment disciplines such as estate management, building, architecture, and engineering (Oladokun, 2012). While this demographic is potentially receptive to innovation, limited experience and training in FM-specific competencies restrict their effectiveness. Only 30% ofsurveyed FM professionals in Nigeria hold formal FM certifications, compared to muchhigher proportions in developed countries (Oladokun, 2012; Atkin & Brooks, 2015). Mobayo et al. (2021) further report that while younger FM practitioners show enthusiasm toward AI adoption, they generally lack the technical skills required for implementation of AI-driven FM.

Studies indicate that the prevalence of operational inefficiencies in Nigeria is high, for instance, Yoade et al. (2022) found that only 42% of staff at the Nigerian Communications Commission expressed satisfaction with FMdelivery,citing issues responsible for the inefficiencies as delayed contractor payments, lack of automation, and slow maintenance response.In the Nigerian universities, excessive reliance on reactive maintenance is particularly problematic. Assets such as plumbing systems or electrical wiring are repaired only after breakdowns, increasing downtime and escalating costs over time (Adewunmi et al., 2011).

The integration technology in FM practice remains rudimentary. Studies by Oladokun (2012) indicate that only about 25%of Nigerian FM organizations use Computer-Aided Facility Management (CAFM)systems,while Building Information Modeling (BIM) and Internet of Things (IoT) adoption are either minimal nonexistent.This stands in contrast to developed countries where digital FM platforms are increasingly applied. Babatunde et al., (2016) observed that infrastructural barriers-such as epileptic electricity supply and low broadband penetration-further restrict the feasibility of real-time AI applications in Nigerian universities.

**Operational Challenges and Systemic Barriers**

Several systemic barriers constrain FM effectiveness in Nigeria:

1. Funding Constraints:Odediranet al.(2015) documented that funding shortfalls result in deferred maintenance and deteriorating infrastructure. Even where AI tools could reduce costs in the long-term, upfront investments in hardware, software, and training remain prohibitive. Mobayoet al.(2021) estimate AI-driven BMS deployment costs at $50,000-$150,000.

This estimate is far beyond the typical FM budget of public universities.

2. Skills Shortages: Studies reveal that over 70% of Nigerian FM professionals lack exposure to AI tools, with only 10% having received technology training in the past fiveyears (Ezeokoli et al., 2021). This gap perpetuates reliance on manual practices and hinders circumstantial innovation especially in the area of AI adoption.
3. Infrastructural Deficits: Power supply interruptions and poor internet connectivity undermine AI systems that require real-time data processing. Ogunleye (2021) notes that broadband penetration in Nigeria remains among the lowest globally,with fixed broadband subscriptions abysmally under 0.03%.
4. Institutional CapacityGaps: Generally, in Nigerian universities, FM units often lack strategic roadmaps for digital transformation. This situation is exacerbated by weak coordination between university administration,ICT departments, and FM teams resulting in fragmented initiatives (Ogunleye,2021).

## AI Applications in Facilities Management: GlobalBenchmarks

Globally, AI application has been successfully integrated into FM across multiple domains:

- Predictive Maintenance: Cheng et al. (2020) established thecapability of machine learning algorithms to anticipate faults in mechanical, electrical, and plumbing (MEP) systems,resulting in the reduction of downtime and extending asset lifespans. In the UK, predictive diagnostics in FM is reported to reduce unscheduled maintenance by 30% (Adam et al., 2021). Energy Management: AI application in FM indicates a high degree of success in energy optimization. Himeur et al. (2020) in their study showed that AI-driven energy optimization in commercial buildings could reduce energy consumption by up to 30%. Al-enabled HVAC controls and lighting systems have the capacity dynamically self-adjust based on occupancy patterns, weather,and usage.
- **SpaceUtilization:** AI is increasingly used to analyze occupancy and optimize space allocation, particularly in academic and corporate environments (Wong et al.,2018). AI tools can recommend room reconfigurations, optimize lecture hall usage, and reduce congestion.
- **SecurityandSafety:** Tools such as Al-powered surveillance, anomaly detection, and drone-assisted monitoring are adopted to improve campus and workplace safety (Pollock, 2024;JLL,2023).

These applications demonstrate AI's transformative role in FM by reducing operational costs,enhancing sustainability, and improving user experience.

## Emerging AI Adoption in Nigerian Universities

Although still at an early stage, Nigerian universities have begun experimenting with AI applications in FM:

- **Smart EnergyMetering**: At the University of Lagos, it has been recorded that AI-enabled energy meters reduced monthly energy consumption by 15% (Akinyemi & Adebayo, 2021). This pilot outcome illustrates AI's potential in addressing chronic energy inefficiencies.
- **Water Management Systems**: Chukwuma et al. (2022) reported that, AI-drivenfault detection in water supply systems at a university campus in Enugu reduced downtime and improved response to leaks.
- **Preventive Maintenance**: Some South-East Nigerian universities are piloting AI-based scheduling systems to pre-empt equipment failures, though progress remains uneven (Mobayo et al.,2021).
- **Campus Security**: Universities are exploring Al-enabled surveillance systems with real-time threat detection capabilities, though issues of data privacy and costs remain concerns.

## Barriers to AI Adoption in Nigerian Facilities

**Management**

### 4.1 Skills Gap and Capacity Limitations

A critical barrier to AI adoption in Nigerian FM is the shortage of professionals with expertise in AI and data science. Implementing AI requires skills in machine learning, predictive modeling,and systems integration, yet these are rare among FM practitioners. Ukachukwu (2024)reported that only 12% of Nigerian universities offer specialized AI or data science programs, leaving the FM workforce underprepared for digital transformation.

The implications of shortage of professional and low requisite skills acquisition are enormous and significant. Ezeokoliet al.(2021) found that 75% of Nigerian FM professionals lacked familiarity with AI tools, while only 10% had received technology training in the past five years. This results in underutilization of even basic AI applications and hinders appropriate innovation.Imported AI solutions often fail because they are designed for temperate climates and highly formalized infrastructure-conditions different from Nigeria's tropical climate, erratic energy supply, and informal building structures. Without local expertise to adapt these tools, they risk being unsustainable.

In advanced economies, continuous professional development (CPD) has been pivotal. Elmualim et al. (2010) reported that over 60% of FM professionals in the UK undergo annual training on emerging technologies. Such initiatives, supported by industry associations and universities,keep professionals aligned with technological trends. In Nigeria, however, FM lacks structured CPD pathways,leaving professionals ill-equipped for present and future digital technology challenges. Embedding AI-focused training within the Nigerian ecosystem- the universities, the Institution of Estate Surveyors and Valuers (NIESV) and other associated organizations inNigeria would be crucial in building a digitally skilled workforce.

**Data Availability and Digitization Challenges**

AI thrives on **large, accurate, andtimelydatasets,** but Nigerian FM suffers from weak data practices. Strusani and Houngbonon (2019) estimated that only 20% of public facilities inNigeria use digital systems for data management. Instead, most FM units rely on manual record-keeping, which is fragmented, inconsistent, and vulnerable to loss.

Okoro and Osunde (2022) surveyed 30 public buildings and found that 85% lacked digitized maintenance logs, with records stored in paper files. This undermines AI applications that rely on historical datasets for predictive modeling. For example, space utilization optimization requires detailed occupancy data, yet Nigerian universities often use manual headcounts (Adewunmi et al.,2011). Without reliable datasets, AI outputs are inaccurate and untrustworthy.

In contrast, developed nations have digitized up to 90% of FM data, enabling effective AI integration (Wong et al., 2018). Nigeria's lag calls for urgent digitization initiatives-including cloud-based record management, standardized data collection protocols, and investment in IoT-enabled sensors. Without addressing data availability, AI integration will remain aspirational rather than operational.

**Financial Constraints and Resource Limitations**

The **high cost** ofAI **implementation** presents another formidable barrier. Mobayo et al. (2021)estimated that AI-driven building management systems cost between $50,000 and $150,000,excluding maintenance and training. By comparison, Odediran et al. (2015) reported that average FM budgets in public universities are only $30,000 annually. This figure is barely sufficient for basic repairs,let alone advanced technologies.

Funding shortfalls are compounded by

Nigeria's limited access to innovation financing.Adebayo and Iweala (2019) found that 70% of FM firms cited financial constraints as their primary barrier to technology adoption, with fewer than 5% receiving government or donor support. This is in contrast to Singapore, where subsidies cover up to 50% of AI adoption costs (Wong et al., 2018).Without similar mechanisms, Nigerian universities remain unable to afford AI innovations.

Creative financing models-such aspublic-private partnerships (PPPs), donor grants, and shared infrastructure investments-could ease this burden. For instance, universities could partner with private energy firms to implement AI-driven energy management systems, with savings shared between partners. Coordination between ICT departments and FM teams is often poor. This fragmentation leads to isolated initiatives rather than integrated systems. Without clear leadership and policy direction, AI adoption risks remaining piecemeal and unsustainable.

**Ethical and Social Implications**

While AI offers efficiency gains, it also raisesethical and social challenges.

1. **DataPrivacy**: Al-driven FM systems often collect sensitive data such as occupant movement patterns, biometric details, and environmental health indicators. In Nigeria,weak enforcement of the Nigeria Data Protection Regulation (NDPR, 2019) increases risks of data misuse and cyberattacks (Aworanti-Ekugo, 2024). A breachin a university surveillance system, for instance, could compromise student privacy and erode trust in AI.
2. **AlgorithmicBias**: AI systems may replicate societal inequities if trained on biaseddata.In Nigeria's diverse, multi-ethnic context, biased AI could unfairly allocate resources,reinforcing existing disparities (Mehrabi et al., 2021).
3. **JobDisplacement**: Automation of FM tasks threatens low-skilled workers in maintenance,cleaning, and security. With unemployment already at 33% (World Bank,2023),AI-induced displacement could worsen social tensions (Olawumi& Chan,2018).While AI creates new roles in data analysis and systems maintenance, these require reskilling, which is currently limited in Nigeria.
4. **DigitalDivide**: AI could deepen inequalities between well-funded private universities that can afford adoption and underfunded public universities that cannot. This risk's widening disparities in service quality and student experiences.
5. **Environmental Impact**: Although AI can reduce energy consumption, its deployment requires hardware, servers, and energy-intensive data centers. Without renewable energy integration, Nigeria's AI adoption could inadvertently increase the incidence of carbonemissions.

**Justification for Adoption, Utilization, and Maintenance Constructs**

This study focuses on three interlinked constructs-adoption,utilization,and maintenance as the foundation for evaluating AI in FM.

- **Adoption:** Refers to the initial decision to explore and invest to integrate AI into FM operations. It reflects institutional readiness, ability, leadership vision, and policy support for the adoption of AI in FM.Adoption provides insight into whether universities are committed to embracing digital modernization or merely experimenting with AI.
- **Utilization:**This goes beyond adoption.It measures the depth and consistency of AI use in daily operations. Venkatesh et al. (2003) highlighted that many technologies are adopted but underutilized. For Nigerian FM, utilization captures whether practitioners and ICT teams actively rely on AI for decision-making, rather than defaulting to manual methods.
- **Maintenance**: This ensures the long-term sustainability of AI systems. This

includessoftware updates, recalibration of algorithms, and technical support. Without maintenance, AIsystems deteriorate, eroding trust and utility. Systems Theory emphasizes feedback loops,making maintenance essential for continuous improvement (Checkland,1999).

Together, these constructs represent a lifecycle perspective on AI adoption. Adoption initiates change, utilization embeds it in practice, and maintenance sustains its benefits. By framing AI evaluation around these constructs, researchers can assess not only whether universities adopt AI,but whether they derive lasting value from it.

### 4.7 Toward a Comprehensive Strategy

Addressing the barriers requires a **holistic, multi-prongedstrategy**:

1. **Infrastructure Investment**: This calls for expanding broadband access, stabilizing and extending electricity supply, and comprehensive digitalization of facility data.
2. **Capacity Building**: This will require the introduction of AI and data analytics modules into FM curricula in educational institutions and mandatory CPD programs for FM professionals.
3. **Policy Reform:** Establishment of national AI guidelines for FM, covering ethics,data governance,and funding.
4. **PilotProjects**: Government-backed AI pilots schemes to be lunched in selected universities to demonstrate essence and build observability.
5. **FundingInnovation**: these innovations are to explore funding outlets like PPPs, donor support, and government subsidies to offset high upfront costs.
6. **Ethical Safeguards**: Strengthen NDPR enforcement and introduce equity-focused

AI regulations.

### Conclusion

The integration of Artificial Intelligence (AI) into Facilities Management (FM) represents one of the most promising pathways for improving efficiency, sustainability, and service delivery in Nigerian universities. Globally, AI has transformed FM practices through predictive maintenance, energy optimization, space utilization, and enhanced security systems. In Nigeria,however, adoption remains at a nascent stage, constrained by systemic barriers such as funding limitations, infrastructural deficits, skills shortages, poor data practices, and weak regulatory frameworks.

The review highlights that while theoretical frameworks such as the Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology Acceptance Model (TAM),the Diffusion of Innovations Theory, and Systems Theory all provide useful insights, the constructs of adoption, utilization, and maintenance are particularly well suited for evaluating AI's lifecycle in FM. Theseconstructs capture the progression from initial investment to sustained operational value,offering a holistic framework for both academic inquiry and practical policy design.

Case evidence from Nigerian universities demonstrates that small-scale pilots-such as smart energy metering and AI-driven water fault detection-can deliver measurable benefits. Yet,these remain isolated initiatives without the scale, visibility, or institutional support requiredforlong-term transformation. Without coordinated strategies, Nigerian FM risks falling further behind global best practices, deepening technological and socio-economic divides.

Overcoming these barriers requires a multi-pronged approach: investment in digital infrastructure, embedding AI and data science into FM curricula, strengthening professional training and continuous development, creating enabling policy and regulatory environments, and fostering partnerships across government, academia, and industry. Ethical considerations-such as data privacy, algorithmic bias, job displacement, and environmental sustainability-must also remain central to ensure AI's integration aligns with Nigeria's broader developmental goals.

In conclusion, while Nigeria faces significant challenges in embedding AI within FM, these challenges are not insurmountable. With deliberate reforms, strategic investments, and inclusive policies, AI can evolve from being a distant aspiration into a practical driver of sustainable FM in Nigerian universities. The urgency of modernization, coupled with the potential for AI to address systemic inefficiencies, underscores the need for immediate, coordinated action to position Nigerian FM as a catalyst for educational excellence and national development.

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