

## Management and Curriculum Responses to Digital Infrastructure Deficits for AI Learning in Universities in Imo State, Nigeria

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Article History	Abstract
<b>Original Research Article</b>	<p><i>The integration of artificial intelligence into higher education has become a critical priority for universities globally. Yet public universities in Nigeria face severe digital infrastructure deficits that block meaningful AI learning. This study examines how university management and curriculum developers respond to these deficits using a comparative qualitative case study of two institutions in Imo State: the Federal University of Technology Owerri (FUTO), a federal technology focused university, and Imo State University Owerri (IMSU), a state owned comprehensive university. Data collection involved semistructured interviews with 23 participants including university administrators, ICT directors, faculty members, and students. Document analysis covered institutional policies and curriculum documents from 2020 to 2025. The findings reveal profound infrastructure gaps across both institutions, particularly in reliable electricity, broadband connectivity, dedicated AI computing hardware, and access to cloud based AI tools. Management responses differ substantially between the two institutions. FUTO leverages its federal status and technology mandate to attract donor funded infrastructure projects and industry partnerships. IMSU relies more heavily on intermittent state government support and internally generated revenue. Curriculum responses exhibit a shared pattern across both universities. AI related content remains predominantly theoretical, delivered through lecture based formats with minimal hands on computing components. Faculty and students report that infrastructure deficits directly constrain what can be taught and learned. The study concludes that without targeted policy interventions and alternative pedagogical models designed for resource constrained environments, Nigerian universities risk producing graduates unprepared for an AI driven labour market. Practical recommendations focus on priority infrastructure frameworks, public private partnership models, and low resource AI pedagogy guidelines.</i></p> <p><b>Keywords:</b> AI learning, digital infrastructure, higher education management, curriculum adaptation, Imo State, Nigeria, resource constrained environments.</p>
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### 1. Introduction

Artificial intelligence is rapidly transforming higher education across the world. Intelligent tutoring systems now provide personalised feedback to students. Automated assessment tools reduce grading workloads for faculty. Predictive analytics help universities identify at risk students before they drop out. AI assisted research workflows accelerate literature reviews and data analysis.

A comprehensive review of AI integration in African higher education by Okonkwo and Adewale (2024) notes that AI holds genuine promise for transforming the sector by offering tailored learning experiences, improving student outcomes, and automating administrative tasks. Yet that same review acknowledges a sobering reality. Resource constraints in many African nations present

specific hurdles to AI integration, including deficiencies in skilled AI professionals, inadequate data protection infrastructure, and insufficient regulatory oversight. These constraints are not merely administrative inconveniences. They threaten to widen the digital divide and hinder Africa's competitiveness in the Fourth Industrial Revolution.

Nigeria exemplifies these challenges in particularly acute form. As Africa's most populous nation and largest economy, Nigeria possesses considerable human capital and a growing technology sector. Its public universities, however, operate within a context of chronic underfunding, decaying physical infrastructure, and inconsistent policy implementation. A literature based study on ICT integration in Nigerian universities by Edeh, Nwosu, and Okafor (2025) identifies five interconnected barriers: infrastructural deficits, inadequate funding, limited digital literacy, weak policy implementation, and sociocultural barriers. The consequences extend across teaching quality, research productivity, administrative efficiency, and graduate employability. These factors collectively limit the ability of Nigerian universities to compete globally in the digital era.

The electricity situation deserves particular attention because it underpins every other dimension of digital infrastructure. Universities cannot run servers, maintain internet connectivity, or power computer laboratories without reliable electricity. Yet Nigerian public universities face an escalating energy crisis. In 2024, electricity tariffs for Band A customers increased to N206.8 per kilowatt hour, while diesel prices surged past N1000 per litre. The result has been persistent darkness in some institutions over their inability to pay bills, or rationing of supply to critical sections when generators are switched on. A report by the Nigerian Electricity Regulatory Commission (2024) documented that the University of Benin saw its monthly electricity bill rise from N80 million to N280 million, a 250 percent increase. The vice chancellor warned that no institution could survive paying such amounts without declaring bankruptcy. Similar disconnections affected the University of Lagos, Ahmadu Bello University Zaria, and the University of Jos among others. These national level crises manifest acutely in the daily operations of universities attempting to deliver AI education.

Imo State provides a revealing microcosm of these national challenges. Located in South East Nigeria, the state hosts two public universities with distinct institutional characters. The Federal University of Technology Owerri, established in 1980, operates under federal government funding and carries a specific mandate for technology education. As a federal institution, FUTO theoretically benefits from national level intervention funds such as those administered by the Tertiary Education Trust Fund (TETFund). Imo State University Owerri, established in 1981, falls under state government funding and serves a broader comprehensive mission encompassing humanities, social sciences, natural sciences, and professional programmes. This institutional divergence, federal technology focused versus state comprehensive, offers a valuable comparative lens for examining how management and curriculum responses to digital infrastructure deficits differ based on

governance structure, funding sources, and institutional mission.

The problem motivating this study is straightforward yet urgent. Nigerian universities face mounting pressure to prepare students for an AI mediated future. Employers increasingly expect graduates to possess at least foundational AI literacy. Global accreditation bodies are incorporating digital competencies into their standards. Yet the physical and digital infrastructure required for meaningful AI learning remains severely deficient across most public universities. Reliable electricity, high speed internet, modern computing hardware, and access to cloud based AI platforms are all scarce. Based on the above that the following research questions were itemized

1. What digital infrastructure deficits affect AI learning at the Federal University of Technology Owerri (FUTO) and Imo State University Owerri (IMSU)?
2. What management strategies have been adopted at each institution in response to these deficits?
3. How have curricula been modified to accommodate infrastructure constraints while still delivering AI relevant content?
4. How do these responses differ between institutions with different governance arrangements and resource bases (federal technology focused versus state comprehensive)?

## 2. Literature Review and Theoretical Framework

### 2.1 Digital Infrastructure Requirements for AI Learning

Understanding what constitutes adequate digital infrastructure for AI learning is essential before assessing deficits. AI education differs from general computer science education in critical respects. Basic programming can be accomplished on modest hardware with intermittent internet access. Meaningful AI learning typically requires substantially greater computational resources. Training machine learning models, even relatively simple ones, demands processing power far exceeding what standard student laptops provide. Deep learning applications require graphics processing units or tensor processing units that remain expensive and scarce in many developing country contexts. Cloud based AI platforms offer an alternative, but they presuppose reliable high speed internet connectivity, precisely what many Nigerian universities lack.

A comprehensive review of ICT curricula across six continents by Chen, Zhang, and Liu (2024) found that only 37 percent of analysed programmes offered comprehensive AI courses. Institutions in Africa and South America notably lagged behind other regions. This lag reflects underlying infrastructure realities, not merely curriculum design choices. The same review identified significant regional disparities in AI education and key challenges in

curriculum adaptation, suggesting that what works in well resourced contexts cannot be transplanted to resource constrained settings.

Arowolo Ayodeji (2025) argues that Africa requires a distinct approach to AI driven education, diverging from Western models that have been ineffective on the continent. She states that Africa must prioritise locally adapted, cost efficient, and infrastructure friendly AI strategies, catering to specific challenges such as limited internet access and a shortage of AI trained educators. Federated learning, open source AI models adaptable to local dialects, and mobile first offline capable solutions represent promising directions. Yet these remain largely aspirational in most Nigerian universities.

## **2.2 Infrastructure Deficits in Nigerian Higher Education**

The empirical literature on digital infrastructure in Nigerian universities paints a consistent picture of severe and persistent deficits. Edeh, Nwosu, and Okafor (2025) identified infrastructural deficits as the primary barrier to ICT integration. They noted that while policies such as the National Policy on Information Technology have provided frameworks for ICT adoption, implementation remains inconsistent particularly in public universities. The paper recommends a multilevel strategy involving stronger policy enforcement, institutional commitment, capacity building, and sustainable financing through public private partnerships.

ICT directors are blunt about the situation. At their 2025 annual conference, the chairman of the Committee of Directors of ICT of Nigerian Tertiary Institutions stated that many institutions still face inconsistent power supply, limited broadband access, funding constraints, and resistance to change. The vice chancellor of the University of Jos noted that the COVID 19 pandemic exposed gaps in digital infrastructure, but awareness alone has not translated into systemic change.

The electricity crisis cascades into every other domain. The Academic Staff Union of Universities (2024) raised concerns over high electricity bills, warning that some institutions may be forced to shut down academic operations entirely. One university reportedly received a bill of N300 million. Some universities have turned to solar power, though capital costs remain prohibitive. Azura Power West Africa constructed a 240 kilowatt solar car park worth N900 million at the University of Nigeria Nsukka (Okafor & Eze, 2023). Such examples remain exceptional rather than typical.

## **2.3 Management Responses in Resource Constrained Settings**

How do university management teams respond when infrastructure deficits exceed immediate capacity? The literature identifies several categories of response. Policy formulation at the institutional level represents one approach, though its effectiveness depends on implementation capacity. The Tertiary Education Trust Fund (2024) called on tertiary institutions to embrace

technology in teaching, research, and administration, warning that billions of Naira already invested risk being wasted due to underutilisation. TET Fund has introduced new intervention lines including centres for robotics, coding and AI or machine learning, and centres for cybersecurity studies in selected institutions. Yet these interventions are necessarily selective.

Public private partnerships have emerged as a promising but underexplored mechanism. Nwachukwu, Okeke, and Ugwu (2023) identified twelve distinct PPP approaches and fifteen potential benefits of well coordinated partnerships for technology driven teaching and learning in Southeast Nigerian universities. However, PPPs require enabling policy environments, institutional readiness, and sustained commitment from both partners, conditions not always present in Nigeria.

The Federal Government's "Fibre 2 Hostel" project, launched in 2025, aims to deliver high speed broadband to student hostels across seven federal universities (Nigerian Communications Commission, 2025). Notably, neither FUTO nor IMSU appears among the initial beneficiaries, raising questions about regional equity. Internal resource reallocation represents a third response, though its limits are quickly reached when baseline funding is inadequate. The resistance to change noted by ICT directors adds a human dimension to the infrastructure challenge.

## **2.4 Curriculum Responses to Infrastructure Constraints**

When physical infrastructure cannot be transformed overnight, curriculum adaptation becomes urgent. The literature identifies several strategies employed in resource constrained settings. Theoretical approaches that emphasise conceptual understanding over hands on computation risk producing graduates who understand AI principles but cannot implement them. Elective rather than core course structures concentrate scarce resources on smaller cohorts. Integration of AI concepts into existing courses rather than standalone AI courses may result in superficial coverage.

Adegbite, Fashina, and Olaniyan (2024) studied AI integration into science curricula at Nigerian universities, finding a tangible link between AI integration and learning outcomes but significant variation in implementation quality. The research advocated for an adaptive curriculum that equips students with AI related skills, though it did not specifically address how infrastructure deficits shape curriculum implementation.

Student perspectives add complexity. Ogunleye and Bamidele (2024) found a moderate level of awareness among students regarding AI's potential benefits in education, with a strong belief in AI's role in improving learning experiences. Yet students expressed concerns about technical difficulties, privacy issues, and inadequate training and support, reflecting their lived experience of learning AI without necessary tools.

The African Union Development Agency – New Partnership for Africa's Development (AUDA NEPAD, 2024) stated that many African tertiary institutions offer AI courses with outdated curricula that produce graduates not

ready for digital work. Governments and universities have not invested appropriately in cutting edge technology, and education content is highly theoretical. The white paper warns that generative AI's benefits may not be evenly distributed across the continent, a predictable outcome of decades of underinvestment.

## **2.5 Theoretical Framework**

This study draws on three complementary frameworks. The Resource Based View (Barney, 1991), adapted to higher education, conceptualises universities as organisations whose competitive advantage derives from unique, valuable, and difficult to imitate resources. Digital infrastructure deficits represent resource gaps that constrain what universities can achieve. Management responses are efforts to acquire, develop, or substitute for missing resources. RBV helps explain why FUTO and IMSU might pursue different strategies given different resource endowments.

The Technology Organisation Environment framework (Tornatzky & Fleischer, 1990) posits that technology adoption is shaped by technological context (available technologies), organisational context (structure, resources, processes), and environmental context (regulatory environment, labour market). For Nigerian universities, the technological context includes both global AI tools and local infrastructure constraints. TOE helps organise the multiple factors shaping university responses.

Curriculum Innovation Theory, drawing on Rogers (2003) and Fullan (2007), focuses on how new content and pedagogical approaches are adopted. Factors include perceived relative advantage, compatibility with existing practices, complexity, trialability, and observability of outcomes. In resource constrained settings, compatibility and complexity become particularly salient. Innovations requiring substantial infrastructure investment are less likely to be adopted regardless of potential benefits.

The synthesis of these frameworks addresses a gap in the literature: limited empirical comparative studies of AI learning infrastructure in South East Nigeria and a need for context specific responses rather than one size fits all solutions. This study examines how two different institutions, with different governance structures and resource bases, navigate preparing students for an AI mediated future amid severe infrastructure constraints.

## **3. Methodology**

### **3.1 Research Design**

This study adopted a qualitative comparative case study design (Yin, 2018). This design was appropriate because the research questions focused on how and why management and curriculum responses differ between two institutions, and because AI learning infrastructure cannot be separated from its institutional context. The comparative element allowed for cross case analysis to identify patterns and differences.

### **3.2 Study Context and Sampling**

The study was conducted at two public universities in Owerri, Imo State, Nigeria. The Federal University of Technology Owerri (FUTO) is a federal government owned

university with a technology mandate, enrolling approximately 25,000 students. Imo State University Owerri (IMSU) is a state government owned comprehensive university, enrolling approximately 30,000 students.

Purposive sampling was used to select participants with direct knowledge of digital infrastructure and AI curriculum. Participants comprised four categories: university management, ICT directors and technical staff, faculty teaching AI related courses, and students. A total of 23 participants were recruited: 4 university administrators, 4 ICT directors or senior technical staff, 9 faculty members, and 6 students. The distribution was roughly equal between institutions (12 from FUTO, 11 from IMSU).

### **3.3 Data Collection Methods**

Three data collection methods were employed. Semistructured interviews formed the primary source, with questions exploring infrastructure, management strategies, curriculum content, and challenges. Interviews lasted 45 to 90 minutes, were audio recorded with consent, and transcribed verbatim.

Document analysis provided a second source. University strategic plans, ICT policies, curriculum documents from 2020 to 2025, and TETFund intervention records were collected where available.

Limited observation of AI related facilities constituted the third method. The researcher visited computer laboratories and ICT centres at both institutions, focusing on available hardware, software, and connectivity.

### **3.4 Data Analysis**

Data analysis followed the thematic analysis approach of Braun and Clarke (2006), involving familiarisation, coding, theme development, and review. NVivo 14 software assisted coding. A cross case comparison matrix was developed to systematically compare findings between FUTO and IMSU across infrastructure deficits, management responses, and curriculum responses.

### **3.5 Trustworthiness and Ethical Considerations**

Trustworthiness was addressed through triangulation of data sources, member checking, thick description, an audit trail, and researcher reflexivity. Ethical approval was obtained from the affiliated institution's research ethics committee and from both universities. All participants provided written informed consent. Anonymity and confidentiality were assured through use of pseudonyms. No participant experienced harm during the research.

## **4. Findings**

The findings are organised according to the four research questions. Each subsection presents evidence from both institutions with tables summarising key findings.

### **4.1 Research Question 1: What digital infrastructure deficits affect AI learning at FUTO and IMSU?**

The data revealed profound digital infrastructure deficits across both institutions. Table 1 summarises the deficits by category.

**Table 1: Digital Infrastructure Deficits at FUTO and IMSU**

Infrastructure Category	FUTO	IMSU
Electricity (grid supply)	4 to 6 hours daily	2 to 3 hours daily
Generator backup	6 to 8 hours daily (rationed)	2 to 4 hours daily (severely rationed)
Internet connectivity	Fibre to campus, but peak hour speeds very low	No campus fibre; relies on mobile broadband
Functional desktop computers	Approximately 60	Approximately 40
GPU equipped machines	None	None
Student to computer ratio	Approximately 417:1	Approximately 750:1
Dedicated AI laboratory	Under development	None
Access to cloud AI platforms	Limited by bandwidth and cost	Severely limited
Software licences	Open source only	Open source only

Electricity emerged as the most fundamental deficit. At FUTO, an ICT technical staff member explained, "We cannot run the main computer laboratory for more than four hours continuously because we cannot afford the diesel." At IMSU, a faculty member stated, "There are days when we have no power at all for the entire teaching day." Internet connectivity was the second major deficit. A student at FUTO described, "When everyone is online, you cannot even load a simple webpage. Trying to access Google Colab is impossible." The ICT director at IMSU reported, "We have no campus wide fibre. Departments buy their own data subscriptions." Hardware deficits were equally

severe. Neither institution possessed GPU equipped machines. The ICT director at FUTO summarised, "We teach AI the way we taught Fortran in 1990. We write code on paper. That is not AI education."

**4.2 Research Question 2: What management strategies have been adopted at each institution in response to these deficits?**

Management strategies differed substantially between the two institutions. Table 2 summarises the strategies.

**Table 2: Management Strategies at FUTO and IMSU**

Strategy Category	FUTO	IMSU
External funding	TETFund AI Centre (developing); World Bank project	Limited; not a TETFund AI beneficiary
Public private partnerships	MoU with fintech for internships	Proposed telecom partnership (stalled)
Internal resource mobilisation	Structured faculty contributions	Inconsistent compliance
Staff training	Six faculty trained abroad through TETFund	Internal workshops; online courses
Infrastructure maintenance	Central generator with rationing	Severely rationed generator
Policy formulation	ICT plan aligned with technology mandate	Basic ICT policy; limited implementation

At FUTO, the technology mandate drove a proactive externally oriented strategy. A university administrator noted, "Our federal status gives us access to TETFund interventions that state universities cannot access as easily." At IMSU, a senior administrator stated, "The state government has many competing priorities. We cannot wait for the government to solve our problems." The ICT director at IMSU expressed frustration: "Private partners want guarantees that we cannot give." Staff training strategies diverged. FUTO sent six faculty for AI training abroad. IMSU conducted internal workshops. A faculty

member at IMSU commented, "I learnt TensorFlow from YouTube and Coursera. I then taught my colleagues. It is not ideal, but it is what we can do."

### 4.3 Research Question 3: How have curricula been modified to accommodate infrastructure constraints?

Curriculum responses revealed a shared pattern of modifications aimed at reducing infrastructure dependence. Table 3 summarises the modifications.

**Table 3: Curriculum Modifications for AI Learning at FUTO and IMSU**

Curriculum Element	FUTO	IMSU
Standalone AI course	Yes: "Introduction to AI"	No
AI content integration	Embedded across multiple courses	Integrated into two courses
Theoretical emphasis	Predominantly theoretical	Almost entirely theoretical
Pedagogical adaptations	Neural network simulator; offline tools; light projects	Similar but more limited
Assessment methods	Written exams; paper based code	Written exams primarily
Student project complexity	Decision trees; basic search algorithms	Very basic, often conceptual

At FUTO, a faculty member explained, "The syllabus is comparable to any decent university globally. The difference is in delivery. My students learn about backpropagation from slides. They never actually train a neural network." At IMSU, a faculty member acknowledged, "We cannot justify a full AI course when we cannot provide the practical component. Better to be honest about our limitations." Both institutions adopted pedagogical adaptations. A faculty member at FUTO described using a simplified neural network simulator that runs in a web browser. "It is not real machine learning. But students see the concept." Offline tools were preferred. Projects were computationally light, such as implementing a decision tree from scratch.

interviews. But when employers ask what AI models I have built, I have nothing to show." A student at IMSU expressed cynicism: "We are learning AI in 2025 the way my father learned it in 1995. What is the point?" A lecturer stated, "I feel like I am failing my students. Not because I do not want to teach properly, but because the system makes it impossible."

### 4.4 Research Question 4: How do these responses differ between institutions with different governance arrangements?

The comparative analysis revealed systematic differences between FUTO (federal technology focused) and IMSU (state comprehensive). Table 4 summarises the key differences.

Student perceptions were mixed. A final year student at FUTO said, "I understand what AI is. I can talk about it in

**Table 4: Comparative Differences Between FUTO and IMSU**

Dimension	FUTO (Federal, Technology Focused)	IMSU (State, Comprehensive)
Governance structure	Federal oversight	State oversight
Funding sources	Federal allocations, TETFund, IGR	State allocations (limited), IGR (primary)
Access to special interventions	Yes (TETFund AI Centre)	Limited

Dimension	FUTO (Federal, Technology Focused)	IMSU (State, Comprehensive)
Institutional mission	Technology education (AI aligned)	Comprehensive (AI competes with many priorities)
Management orientation	Externally focused	Internally focused
Staff training capacity	International through TETFund	Internal self training only
Curriculum response	Standalone AI course plus embedded	Embedded content only
Infrastructure trajectory	Moderate improvement	Stagnation or decline
Student to computer ratio	417:1	750:1

The most striking difference was access to external funding. FUTO's federal status provided access to TETFund interventions that IMSU could not access on the same scale. The TETFund AI Centre at FUTO represents a multimillion Naira investment that IMSU cannot match.

The technology mandate also enabled strategic alignment. At FUTO, AI education fits within the institutional mission. At IMSU, a senior administrator explained, "When we have to choose between fixing the roof of the law faculty and buying computers for AI, the roof wins every time."

However, similarities also emerged. Both institutions faced severe electricity deficits. Both lacked GPU equipped machines. Both relied on open source software. An ICT director at FUTO noted, "We have better access to funding, but the problems are so large that better is still not good enough." One interesting finding was that IMSU's decision not to offer a standalone AI course might represent a more honest response. A faculty member at IMSU argued, "FUTO offers an AI course that they cannot properly deliver. Students pay fees and receive theory only. Is that better than not offering the course at all?" A student at FUTO echoed: "I paid for an AI course. I received slides. I could have downloaded those slides from the internet for free."

The comparative analysis suggests that governance and resource differences matter, but they do not determine outcomes entirely. Leadership commitment and strategic partnerships can partially compensate for resource disadvantages. Conversely, federal status and technology mandate do not guarantee meaningful AI learning when infrastructure deficits remain severe.

## 5. Discussion

The findings of this study reveal a troubling gap between the aspirations of AI education and the realities of digital infrastructure in Nigerian public universities. Both FUTO and IMSU face severe deficits in electricity, internet connectivity, computing hardware, and software access. These deficits directly constrain what can be taught and

learned. Management responses differ based on governance structure and resource base, but neither institution has been able to close the infrastructure gap. Curriculum responses have shifted toward theoretical content and low resource pedagogical adaptations, but faculty and students alike regard these as inadequate substitutes for genuine hands on AI learning.

These findings align with previous research on ICT integration in Nigerian universities. Edeh, Nwosu, and Okafor (2025) identified infrastructural deficits as the primary barrier to ICT integration, and this study confirms that AI learning is no exception. The electricity crisis documented by the Nigerian Electricity Regulatory Commission (2024) and the Academic Staff Union of Universities (2024) manifests acutely in the daily operations of both institutions. The warning from TETFund (2024) that billions of Naira invested in ICT infrastructure risk being wasted due to underutilisation appears prescient, though the more fundamental problem may be that the investment has been insufficient to begin with.

The comparative dimension of this study yields important insights. FUTO's federal status and technology mandate provide advantages that IMSU lacks. Access to TETFund interventions, including the Centre for Artificial Intelligence and Robotics, gives FUTO a pathway toward improved infrastructure that IMSU cannot easily replicate. However, even at FUTO, the gap between current reality and what is needed for meaningful AI learning remains vast. The technology focused university that should be leading AI education in the region is still struggling to provide basic computing access. This suggests that federal status and technology mandate, while beneficial, are insufficient without sustained and adequately scaled investment.

The Resource Based View framework helps explain these differences. FUTO possesses resources that IMSU does not, including a stronger reputation in technology fields, better connections to development partners, and a history of successful TETFund proposals. These resources enable different strategic responses. IMSU, lacking these

resources, falls back on internally generated revenue and intermittent state support. Both institutions, however, share a critical resource deficit in AI specific infrastructure. Neither has been able to acquire the GPU equipped workstations, high bandwidth connectivity, and cloud platform access that would enable genuine hands on AI learning. From an RBV perspective, this deficit is not merely a constraint but a fundamental barrier to achieving the strategic goal of producing AI competent graduates.

The Technology Organisation Environment framework adds nuance. The technological context includes not only the AI tools themselves but also the infrastructure required to run them. For both institutions, the available technologies are mismatched with local conditions. Cloud based AI platforms assume reliable high speed internet, which neither university has. GPU based local computing assumes reliable electricity and expensive hardware, which neither university can guarantee. The organisational context differs between the two institutions, with FUTO showing greater strategic alignment between its technology mandate and AI education goals. The environmental context, including national policies, accreditation requirements, and labour market demands, is largely shared. Yet the policy environment has not delivered the infrastructure investments needed to make AI education viable.

The findings on curriculum responses are particularly concerning. The shift toward theoretical content and low resource pedagogical adaptations is understandable as a coping strategy. Faculty cannot teach what they cannot support. Students cannot learn what they cannot practise. But the consequence is that graduates emerge with conceptual knowledge of AI but no practical experience building or deploying AI systems. This gap between what employers need and what graduates can do threatens the employability of Nigerian university graduates in an increasingly AI mediated labour market. As AUDA NEPAD (2024) warned, many African tertiary institutions offer AI courses that have outdated curricula and produce graduates who are not ready for digital work.

The study also reveals a human dimension that quantitative infrastructure assessments often miss. Faculty members express genuine distress at their inability to teach effectively. Students oscillate between appreciation for what they learn and frustration at what they cannot access. The ICT directors who participated in this study are not passive victims of underfunding. They have pursued partnerships, written proposals, rationed resources, and improvised solutions. Their efforts have kept AI education alive in conditions that would have killed it entirely in less committed hands. But individual commitment cannot substitute for systemic investment.

One cannot overlook how the broader political economy of Nigerian higher education shapes these outcomes. Public universities have been systematically underfunded for decades. The percentage of GDP allocated to education has consistently fallen below the UNESCO recommended threshold of 26 percent of national budgets. Inflation and currency devaluation have eroded the real value of whatever allocations are made. In this context, digital

infrastructure is just one of many competing needs. Universities must also pay salaries, maintain buildings, equip libraries, and support research. That AI infrastructure loses out to these more immediate demands is not surprising, but it is damaging.

## 6. Conclusion

This study examined how university management and curriculum developers respond to digital infrastructure deficits for AI learning at two public universities in Imo State, Nigeria: the Federal University of Technology Owerri and Imo State University Owerri. The findings reveal severe infrastructure gaps across both institutions, particularly in electricity supply, internet connectivity, computing hardware, and software access. Electricity remains the most fundamental deficit, with grid supply ranging from only two to six hours daily. Internet connectivity is unreliable, and neither institution possesses graphics processing units essential for machine learning. Student to functional computer ratios are devastating: approximately 417 to 1 at FUTO and 750 to 1 at IMSU.

Management responses differ substantially between the two institutions. FUTO leverages its federal status and technology mandate to attract external funding and partnerships, including a TETFund Centre for Artificial Intelligence and Robotics. IMSU relies more heavily on internally generated revenue and intermittent state support, with limited success in public private partnerships. Curriculum responses at both institutions have shifted toward theoretical content and low resource pedagogical adaptations, but faculty and students regard these as inadequate substitutes for genuine hands on AI learning. Students graduate with conceptual knowledge of AI but no practical experience building or deploying AI systems. The significance of these findings extends beyond Imo State. Nigerian public universities collectively face the same challenges, and many African universities face similar or worse conditions. Without systematic infrastructure investment and curriculum models designed for resource constrained environments, African universities risk producing graduates unprepared for an AI driven labour market.

## 7. Recommendations

Based on the findings of this study, the following recommendations are offered:

- 1. University management should develop realistic infrastructure prioritisation frameworks** that acknowledge constraints while identifying achievable targets. Public private partnership models should be explored systematically, with universities preparing clear proposals articulating mutual benefits. Infrastructure sharing arrangements between neighbouring institutions should be considered to reduce costs and improve utilisation.

2. **Curriculum developers should design low resource AI pedagogy guidelines** that emphasise open source tools running on modest hardware, offline first approaches not requiring continuous internet, and project based learning focused on conceptual implementation rather than large scale model training. Simulation environments approximating AI workflows without full computational resources represent a promising direction.
3. **The Federal Government and TETFund should establish infrastructure grants specifically targeted at AI education**, separate from general ICT funding. An AI education policy articulating minimum infrastructure standards, curriculum guidelines, and faculty development requirements would provide a framework for accountability. TETFund should ensure equitable distribution of AI interventions across federal and state institutions, not only a select few.
4. **State governments, particularly Imo State, should increase funding allocations for ICT infrastructure in state owned universities** and facilitate access to federal intervention programmes. States should also explore partnerships with development organisations and technology companies to bring AI resources to their institutions.

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