

BOOK CHAPTER | AI in Universities

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Artificial Intelligence in Nigerian Universities: Benefits, Challenges and Future Direction

Omorogiuwa Osaremwinda (PhD)

Department of Computer Science & Information Technology
College of Natural & Applied Sciences
Igbinedion University Okada, Edo State Nigeria
ask4osas@iuokada.edu.ng

ABSTRACT

Artificial Intelligence (AI) is increasingly recognized as a transformative element in education, providing innovative tools and methodologies that can significantly enhance learning experiences. In Nigeria, the integration of AI technologies within universities is gaining attraction, prompting a critical examination of their effects on students' academic performance. Recent research underscores the potential advantages of AI in educational environments, particularly in fostering student motivation and engagement. For example, a systematic review by García-Martínez et al. (2023) revealed that AI can improve students' attitudes towards learning, aiding in the comprehension of complex subjects while offering personalized educational experiences. Artificial Intelligence (AI) has transformed various industries, including education, by providing significant advantages in science education. These benefits include tailored learning experiences, automated grading processes, adaptive learning technologies, and improved research capabilities. However, universities in Nigeria encounter major obstacles in adopting AI due to issues related to infrastructure, technology, and workforce skills

Keywords: Artificial Intelligence, Nigeria, Universities, Benefits, Challenges, Future Direction

INTRODUCTION

A study by Bilal et al., (2024) highlighted that Artificial Intelligence (AI) is becoming a game changer in education, providing new methods to improve teaching and learning.

Technologies like machine learning, natural language processing, and intelligent tutoring systems can greatly enhance the educational experience by offering personalized learning, automating administrative tasks, and giving immediate feedback to students. In science education specifically, AI helps students grasp complex ideas through interactive platforms and simulations. It also aids teachers by automating grading, tracking student progress, and customizing instructional materials to fit individual student needs (Olatunde-Aiyedun, 2024). The implementation of Artificial Intelligence (AI) in education, especially in Nigerian universities, has been relatively slow. Although AI offers many promising benefits, several factors hinder its widespread use in higher education institutions across Nigeria.

Key among these is inadequate infrastructure, which includes unreliable internet access, outdated hardware, and limited availability of advanced AI tools (Adeniran et al., 2024). Additionally, there is a significant absence of AI-focused curricula and training programs for faculty, which are essential for equipping educators to effectively integrate AI tools into their teaching and research practices (Shin et al., 2024). While AI has demonstrated considerable potential to enhance research capabilities and curriculum development in other regions, its benefits remain largely untapped in Nigeria due to ongoing budget constraints and gaps in technological infrastructure.

According to Yakubu et al. (2024) indicated that Nigerian universities has traditionally faced challenges such as insufficient funding, limited access to state-of-the-art research tools, and a reliance on conventional teaching methods. As a result, the integration of AI in research practices has been minimal, and there is a lack of substantial evidence on its impact on academic outcomes. Despite these challenges, some Nigerian universities have begun exploring AI-based teaching tools and research applications, albeit at a limited scale, (Akindeyi et al., 2024). Faculty members have expressed interest in using AI for research data analysis and enhancing classroom experiences, but the lack of training and support for AI implementation remains a persistent issue (Shin et al., 2024). Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the twenty-first century.

Across the globe, universities are increasingly integrating AI into teaching, learning, research, administration, and decision-making processes. In Nigeria, the higher education sector has gradually embraced AI technologies to improve academic delivery, automate institutional processes, and enhance research productivity. The growing use of intelligent systems such as chatbots, machine learning tools, adaptive learning platforms, plagiarism detectors, and generative AI tools has significantly altered the educational

landscape. In recent years, especially after the COVID-19 pandemic, Nigerian universities experienced accelerated digital transformation, thereby increasing awareness and adoption of AI-driven educational technologies (Omorogiuwa et al., 2023).

Despite its immense potential, the integration of AI into Nigerian universities also raises several concerns. Issues such as inadequate infrastructure, poor internet connectivity, lack of technical expertise, ethical concerns, data privacy risks, digital inequality, and overdependence on AI technologies continue to challenge effective implementation. Additionally, there are concerns regarding academic integrity, particularly with the increasing use of generative AI tools by students for assignments and research work. This chapter examines the concept of Artificial Intelligence, traces its emergence and impact in Nigerian universities, explores its benefits and challenges, and discusses future directions for AI adoption in Nigeria's higher education system.

2. WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial Intelligence refers to the simulation of human intelligence in machines and computer systems that are programmed to think, learn, reason, and make decisions. AI systems are designed to perform tasks that normally require human intelligence, such as speech recognition, problem solving, language translation, learning from experience, and decision making. AI combines several technologies including machine learning, natural language processing, robotics, computer vision, expert systems, and neural networks. Machine learning enables systems to learn from data without being explicitly programmed, while natural language processing allows machines to understand and generate human language.

Omorogiuwa et al., 2023) states that the basic elements that a system can possess to qualify it as an intelligent system are reasoning, communication and learning (see Fig. 1). Reasoning is the ability of a machine to apply knowledge based on contextual information in making decisions which could be fuzzy, but the results can be dependable. Communication is the ability of the computing system to be able to express itself using natural languages that can be understandable and dependable. Learning is the ability of a computing system to be able to improve on its existing knowledge-base from new contextual information. It can also be seen as the situation whereby the system becomes autonomous and continuously improve on itself based on contextual information. A computer system that has the ability to reason, communicate and learn just like humans can be regarded as Artificial Intelligence (AI), (Omorogiuwa et al., 2023).



**Fig. 1: Basic Elements of Artificial Intelligent Systems
(Omorogiuwa et al., 2022)**

According to researchers, AI can be categorized into two major types: narrow AI and general AI. Narrow AI refers to systems designed for specific tasks such as recommendation systems, virtual assistants, or plagiarism detection software. General AI, which is still largely theoretical, refers to machines capable of performing any intellectual task that a human being can perform.

In education, AI technologies are used to facilitate adaptive learning, intelligent tutoring systems, automated grading, virtual learning assistants, predictive analytics, and student support systems. AI tools such as ChatGPT, Grammarly, and plagiarism detection software have become increasingly popular among university students and lecturers. The educational sector globally has experienced growing adoption of AI because of its ability to personalize learning experiences, improve efficiency, and expand access to knowledge, (Adegbite, 2022). Studies have shown that AI technologies can improve learner engagement, support research activities, and provide real-time feedback to students, (Owoc et al., 2021).

3. WHEN DID ARTIFICIAL INTELLIGENCE START TO HAVE IMPACT IN NIGERIAN UNIVERSITIES?

The impact of AI in Nigerian universities became more noticeable during the late 2010s and early 2020s. Although computer based systems and educational technologies had existed earlier, the widespread use of AI-powered applications accelerated after the COVID-19 pandemic in 2020. During the lockdown period, universities relied heavily on online learning platforms, virtual classrooms, and digital communication systems. This shift increased awareness and adoption of AI-driven educational technologies.

Before this period, AI usage in Nigerian universities was relatively limited and mainly confined to research laboratories, computer science departments, and isolated academic projects, (Chen et al., 2020). However, the emergence of affordable internet services, increased smartphone penetration, cloud computing, and publicly accessible AI tools contributed significantly to AI adoption in higher education. The release and popularity of generative AI systems such as ChatGPT further accelerated AI awareness among students and lecturers. Nigerian universities began exploring AI for academic advising, research support, online assessment, plagiarism detection, and virtual student support services.

Several Nigerian universities have also introduced AI-related academic programs, research centers, and innovation hubs. Institutions such as Igbinedion University Okada, University of Lagos, Covenant University, and Federal University of Technology Owerri have increasingly promoted AI research and digital innovation. Research indicates that Nigerian students generally demonstrate positive attitudes toward AI technologies, especially regarding adaptive learning and academic support services. Lecturers have also shown increasing readiness to adopt AI technologies despite concerns about training and institutional support, (Ebiringa et al., 2025).

4. BENEFITS OF ARTIFICIAL INTELLIGENCE IN NIGERIAN UNIVERSITIES

a. Personalized Learning

One major benefit of AI in Nigerian universities is personalized learning. AI-powered systems can analyze students' learning patterns, strengths, and weaknesses to provide customized learning experiences. Adaptive learning platforms help students learn at their own pace while receiving targeted recommendations and feedback. This is particularly important in Nigerian universities where classrooms are often overcrowded, making individualized attention difficult. AI systems can bridge this gap by offering personalized tutoring and learning support, Bamidele & Tijani (2026).

b. Improved Research Activities

AI has significantly enhanced research activities in Nigerian universities. Researchers now use AI tools for data analysis, literature review, pattern recognition, predictive modeling, and academic writing assistance. Machine learning algorithms can process large volumes of data more efficiently than traditional methods. AI also supports interdisciplinary research by enabling collaboration across different academic fields.

Researchers can identify trends, generate insights, and improve the quality of academic publications, Usman (2025).

c. Administrative Efficiency

University administration involves repetitive and time-consuming tasks such as student registration, admission processing, timetable scheduling, record management, and responding to student inquiries. AI-powered systems and chatbots help automate many of these tasks, thereby improving efficiency and reducing human error. For example, AI chatbots can provide instant responses to frequently asked questions regarding admissions, course registration, and examination schedules.

d. Enhanced Access to Educational Resources

AI technologies improve access to educational materials through intelligent search systems, digital libraries, recommendation engines, and virtual learning environments. Students in remote locations can access lectures, tutorials, and academic resources online. This is highly beneficial in Nigeria where educational inequalities and limited access to quality learning materials remain major concerns, (Amina et al., 2025).

e. Automation of Assessment and Feedback

AI systems can automate grading and provide instant feedback to students. Objective tests, quizzes, and assignments can be evaluated quickly and accurately, thereby reducing lecturers' workload. Automated assessment systems also help students identify mistakes and improve learning outcomes through timely feedback.

f. Support for Students with Disabilities

Artificial Intelligence powered assistive technologies improve learning opportunities for students with disabilities. Speech recognition systems, text-to-speech applications, automated captioning, and intelligent tutoring systems help create more inclusive educational environments. These technologies can assist visually impaired or hearing-impaired students in accessing educational content more effectively.

g. Promotion of Innovation and Digital Skills

The adoption of AI in universities encourages innovation, creativity, and digital literacy among students and lecturers. Students gain exposure to emerging technologies that are increasingly relevant in the modern labor market. AI education also supports entrepreneurship and technological innovation within Nigerian universities.

5. CHALLENGES OF ARTIFICIAL INTELLIGENCE IN NIGERIAN UNIVERSITIES

a. Inadequate Infrastructure

One of the biggest challenges facing AI adoption in Nigerian universities is poor infrastructure. Many institutions suffer from unstable electricity supply, poor internet connectivity, outdated computer systems, and inadequate digital facilities. AI technologies require reliable internet access, high-performance computing systems, and stable power supply for effective implementation. (Amina et al., 2025).

b. Lack of Technical Expertise

There is a shortage of AI professionals, data scientists, and trained personnel in many Nigerian universities. Many lecturers and administrators lack the technical skills necessary to effectively use AI tools. This knowledge gap limits the successful integration of AI technologies into teaching and administrative processes. (Obadiaru & Anita, 2025).

c. High Cost of Implementation

AI systems can be expensive to acquire, maintain, and upgrade. Many Nigerian universities face financial constraints and may struggle to invest in advanced technologies. Costs associated with software licensing, cloud services, infrastructure development, and staff training can hinder adoption.

d. Ethical and Privacy Concerns

AI systems often rely on large amounts of data, raising concerns regarding privacy, surveillance, and data protection. Student records and personal information may be vulnerable to misuse or unauthorized access. There are also concerns about algorithmic bias, transparency, and accountability in AI decision-making processes.

e. Academic Integrity Issues

The increasing use of generative AI tools has raised concerns about plagiarism, cheating, and academic dishonesty. Some students misuse AI tools to generate assignments, essays, and research content without proper understanding or attribution. Universities are therefore challenged to develop policies and guidelines governing responsible AI usage.

f. Resistance to Change

Some lecturers and administrators resist AI adoption due to fear of job displacement, lack of digital literacy, or skepticism regarding technology. Institutional resistance can slow down innovation and reduce the effectiveness of AI implementation initiatives.

g. Digital Divide

The digital divide remains a significant challenge in Nigeria. Students from rural or economically disadvantaged backgrounds may lack access to smartphones, laptops, or internet connectivity required for AI-powered learning. This inequality may widen educational disparities rather than reduce them.

6. ETHICAL DIMENSIONS OF AI

Ethical Dimensions of AI refers to the moral considerations and societal impacts that arise from developing and deploying artificial intelligence systems. It involves examining how AI affects human rights, fairness, accountability, transparency, and social well being. Key concerns include bias and discrimination when AI systems, trained on biased data, produce unfair outcomes. For example, an AI used in university admissions or hiring might unintentionally favor certain demographic groups over others (Stefan 2024). Privacy is another dimension, especially when AI collects and analyzes sensitive personal data, as seen in student monitoring or predictive analytics platforms.

Transparency and explainability are critical; decisions made by complex AI models such as automated grading or financial aid recommendations can be difficult to understand or challenge. Accountability questions arise when it is unclear who is responsible for errors or harmful outcomes caused by AI. Moreover, issues like job displacement through automation and the ethical use of AI-generated content (e.g., deepfakes or AI-written essays) also surface. These aforementioned ethical challenges AI, pose serious risks especially within university education, where equity, inclusivity, and academic integrity are core principles (Binns, 2018; Jobin, et al., 2019). Hence as AI continues to find application in higher education, the need for deliberate, ethical integration becomes more urgent. The absence of clear institutional policies and ethical frameworks creates what is known as policy gap. This gap invariably results in the misuse of AI, makes worse social inequalities and weakening public trust in higher education systems (Floridi et al., 2018). Suffice to state that policy gaps in ethical AI refers to the lack of comprehensive rules, frameworks, or guidelines that adequately address the ethical, legal, and social challenges posed by AI systems.

These gaps emerge when existing policies fail to keep pace with rapid technological advancements, leaving unclear how to manage issues like bias, privacy, accountability, and transparency. For instance, many universities may adopt AI-driven tools for grading or student analytics without clear policies on data protection, explainability, or redress mechanisms for unfair decisions (Floridi et al., 2019). Globally, while some guidelines exist like the European Commission's Ethics Guidelines for Trustworthy AI enforcement mechanisms and sector-specific regulations, particularly in education, often remain underdeveloped (European Commission, 2019). T

his creates risks where AI applications outpace institutional readiness, undermining core academic values such as equity and integrity. Bridging these gaps requires not just high-level principles but concrete, enforceable policies tailored to specific contexts like higher education. Without this, institutions may struggle to implement AI responsibly and protect stakeholders' rights. Therefore, as a way to address the obvious lacuna of absence of clear institutional policies and ethical frameworks in some universities, in recent years, universities worldwide have begun addressing these concerns by adopting institutional policies and building capacity for ethical AI development and deployment.

For instance, institutions like Stanford, MIT, and Oxford have established AI ethics centers, revised curricula to include responsible AI modules, and adopted institutional guidelines to promote fairness, accountability, and transparency (Marda, 2018). Stanford's Institute for Human-Centered Artificial Intelligence (HAI) focuses on interdisciplinary research that integrates ethics and policy into AI advancements (Stanford HAI, 2020). Massachusetts Institute of Technology (MIT)'s Schwartzman College of Computing embeds ethical reasoning and societal impact discussions into all computing courses (MIT, 2019). Oxford's Digital Ethics Lab investigates the ethical, legal, and social implications of digital technologies, informing responsible AI deployment (Oxford Internet Institute, 2020).

Similarly, the European Commission's Ethics Guidelines for Trustworthy AI earlier mentioned emphasizes principles such as human agency, privacy, transparency, and accountability, urging institutions to uphold human-centric values and legal compliance (European Commission, 2019). These guidelines have influenced universities to adopt practices like transparent AI-based assessment tools, equitable predictive analytics in student support systems, and strict data protection measures in educational platforms. For example, some universities now use explainable AI models for admissions decisions to reduce bias and ensure fairness (Floridi et al., 2019).

Such initiatives ensure that AI deployment in education aligns with ethical standards, protecting equity and academic integrity). However, many African countries, including Nigeria, are still in the early stages of establishing such structures. Nigeria's AI strategy appears to still be in the process of evolution, and it is not yet clear whether the education sector has established well-defined ethical frameworks for the application of AI in teaching, learning, and research (NITDA, 2022). Nigerian universities therefore seem to face the dual challenge of integrating advanced AI technologies while at the same time developing sufficient institutional capacity to manage such integration ethically and responsibly.

In this context, institutional capacity for ethical AI adoption may be understood, first, as the readiness and ability of an organization to implement policies, deploy technologies, and sustain change over time (Grindle et al., 1995), and second, as the availability of qualified human resources, digital infrastructure, technical support, research capabilities, ethical leadership, and financial resources. Without certainty, these elements, institutions may struggle to translate ethical principles into practice, even where there is awareness of the risks involved (UNESCO, 2021). Thirdly, it also implies the university's ability to adopt, implement, and manage AI technologies in ways that uphold ethical standards and social responsibility.

This capacity encompasses having the necessary technical infrastructure, skilled personnel, governance structures, and policies that ensure AI is used transparently, fairly, and in alignment with human rights. Furthermore, it involves training educators, administrators, and students on ethical AI practices, establishing clear data protection policies, and creating oversight mechanisms to monitor AI applications and mitigate risks like bias, discrimination, and privacy breaches (Floridi et al., 2019). For example, a university with strong institutional capacity would have ethics review boards to assess AI-based decision tools in admissions or grading, and enforce accountability when AI systems impact students' academic outcomes.

The European Commission (2019) highlights that trustworthy AI requires institutions to not only adopt ethical guidelines but also demonstrate operational readiness—meaning they can practically apply these principles in daily practices. This operational readiness must be embedded within clear and robust corporate institutional policies that guide the responsible development, deployment, and oversight of AI systems. Without such policies and institutional capacity, universities risk implementing AI in ways that undermine equity, inclusivity, and academic integrity.

Building both policy frameworks and practical capacity ensures that AI enhances education while safeguarding individual rights and promoting societal well-being, (Amina et al., 2025).

7. FUTURE EVOLUTION OF AI

The diagram in Figure 2 illustrates the projected future evolution of Artificial Intelligence (AI) from its present state to more advanced stages of machine intelligence. It identifies three major phases of AI development: Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super Intelligence (ASI).

1. Artificial Narrow Intelligence (ANI) – “Today”

Artificial Narrow Intelligence represents the current stage of AI development. It refers to AI systems that are designed to perform specific tasks within limited domains. These systems can only operate based on the functions they were programmed or trained to execute. Examples include virtual assistants like Siri and Alexa, recommendation systems on YouTube and Netflix, facial recognition software, chatbots, and plagiarism detection tools. The diagram describes ANI as being “less than human intelligence” because these systems cannot think, reason, or make decisions outside their assigned tasks. Although ANI is highly efficient in specialized areas, it lacks true understanding, consciousness, and general reasoning abilities.

2. Artificial General Intelligence (AGI) – “2040”

Artificial General Intelligence refers to a future stage where machines may achieve intelligence equal to that of humans. AGI systems would be capable of learning, reasoning, understanding, and solving problems across multiple fields just like human beings. Unlike ANI, AGI would not be restricted to a single task. It could transfer knowledge from one domain to another, adapt to new situations, and independently perform intellectual activities. The diagram predicts AGI around the year 2040, though this remains speculative. If achieved, AGI could revolutionize education, healthcare, science, engineering, and many other sectors by providing human-level problem-solving capabilities.

3. Artificial Super Intelligence (ASI) – “2060”

Artificial Super Intelligence represents the hypothetical future stage where AI surpasses human intelligence in virtually every aspect. ASI systems would possess superior reasoning, creativity, learning speed, memory, and decision-making abilities beyond human capacity.

The diagram projects ASI around the year 2060 and describes it as “far greater than human intelligence.” At this stage, AI may be capable of making scientific discoveries, solving highly complex global problems, and performing tasks that humans cannot fully comprehend. However, ASI also raises serious ethical, social, and security concerns. Experts worry about issues such as loss of human control, job displacement, privacy violations, and the potential misuse of highly intelligent autonomous systems.

The arrow-shaped progression in Figure 2 symbolizes the continuous advancement of AI over time. It suggests that AI is expected to evolve from specialized systems (ANI) toward more intelligent and autonomous forms (AGI and ASI). The diagram also reflects the increasing level of machine intelligence as AI develops from being below human intelligence to eventually surpassing it.

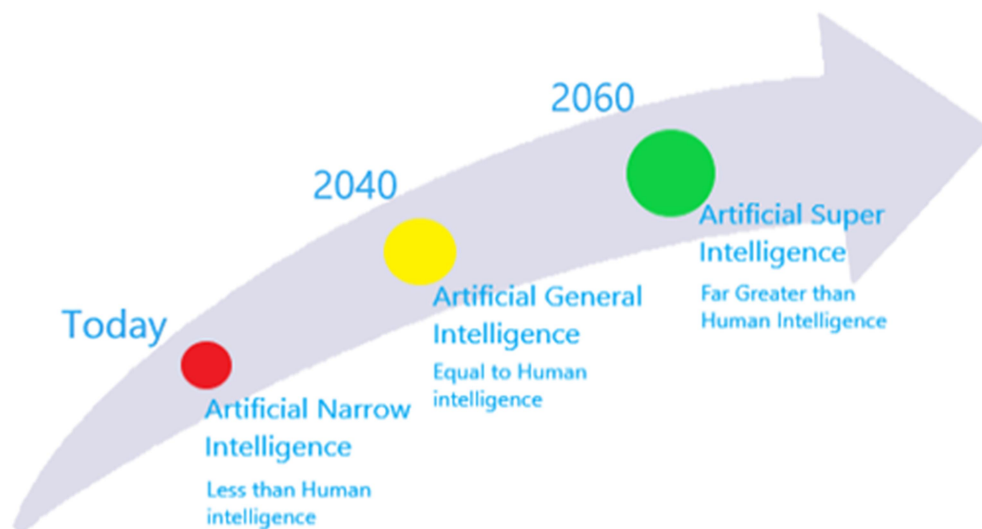


Fig 2: Future Evolution of Artificial Intelligence (Ballant, 2018)

7.1 Future Directions of Artificial Intelligence in Nigerian Universities

i. Expansion of AI Research and Innovation

Nigerian universities are likely to increase investment in AI research, innovation hubs, and interdisciplinary collaboration. More institutions may establish AI laboratories and specialized academic programs. This could position Nigeria as a major contributor to AI development in Africa.

ii. Development of AI Policies and Ethical Frameworks

Future AI adoption will require clear policies regulating data privacy, ethical AI usage, academic integrity, and institutional governance. Universities and government agencies such as National Universities Commission are expected to develop frameworks guiding responsible AI integration.

iii. Increased Use of Generative AI in Education

Generative AI tools are expected to become more integrated into teaching, learning, and research. Lecturers may increasingly use AI for lesson preparation, automated feedback, curriculum development, and academic support. Students may also rely more heavily on AI assistants for learning and research activities.

iv. Improvement in Digital Infrastructure

For AI to thrive, Nigerian universities must improve internet connectivity, electricity supply, cloud computing infrastructure, and digital learning environments. Government support and private-sector partnerships will be essential for sustainable digital transformation.

v. Capacity Building and Training

Future progress depends heavily on training lecturers, administrators, and students in AI literacy and digital skills. Universities will need to organize workshops, seminars, and certification programs on AI technologies.

vi. Greater Industry Collaboration

Collaboration between universities and technology companies may increase significantly. Partnerships with organizations such as Google, Microsoft, and Nigerian tech startups may support AI research, internships, and innovation programs.

vii. Smart Campus Development

Future universities may evolve into smart campuses powered by AI technologies. Intelligent systems could manage security, energy consumption, classroom scheduling, attendance monitoring, and student support services. This transformation may significantly improve efficiency and educational quality.

8. CONCLUSION

Artificial Intelligence has become an important technological innovation influencing higher education globally, including Nigeria. Nigerian universities are increasingly adopting AI technologies to improve teaching, learning, research, and administrative processes. AI offers numerous benefits such as personalized learning, enhanced research capabilities, administrative automation, and improved access to educational resources. However, the successful integration of AI in Nigerian universities is constrained by infrastructural limitations, inadequate funding, digital inequality, lack of technical expertise, ethical concerns, and academic integrity issues. Despite these challenges, the future of AI in Nigerian universities remains promising.

To maximize the benefits of AI, stakeholders including government agencies, university administrators, lecturers, students, and private organizations must collaborate to improve infrastructure, develop ethical policies, invest in capacity building, and promote responsible AI usage. With proper planning and implementation, AI has the potential to transform Nigerian universities into more efficient, innovative, and globally competitive institutions.

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