

Briefing Note



Emerging digital technologies: Adaptability and ethical use for teaching and learning

Executive Summary

The Fourth Industrial Revolution (4IR) is characterized by emerging technologies that include, Artificial Intelligence (AI), data science among other technologies. Such technologies are providing unparalleled changes and opportunities for African agriculture, education, and innovation systems. African higher agricultural education ought to harness the emerging digital technologies to drive sustainable development, promote food security and equip the graduates with 21st century skills to optimize inputs, reduce post-harvest losses, and increase resilience to climate and market shocks (World Bank, 2023; FAO and ITU, 2024) to name a few.

Despite the potential opportunities that these emerging technologies offer for educational innovation and access, Africa continues to face challenges in scaling deployment due to limited digital infrastructure, human capacity, inadequate regulatory frameworks, equity and ethical issues relating to data sovereignty and algorithmic bias (OECD, 2022).

This briefing note is a synthesis of outcomes and recommendations for intentional technology integration in university education as agreed during the 21st RUFORUM Annual General Meeting (AGM) and its high-level continental dialogue on Artificial Intelligence, Data Science, and Emerging Technologies: Transforming Africa Agriculture, Education, and Innovation Systems. The convening recommended concerted policy actions and solutions by African governments and institutions to foster flexible, inclusive, and responsible integration of digital technology into agricultural teaching, learning, research and development towards future-ready agriculture graduates.

Key recommendations include:

- i. Develop ethical and inclusive frameworks: guidelines for data privacy, responsible use of AI, and online safety in education and addressing technological access gaps, prioritizing rural and marginalized communities.
- ii. Re-skill and build human capital skills to retain talent: retool higher education faculty and students on emerging digital tools, pedagogy, and learning analytics.
- iii. Develop and invest in digital infrastructure and technology access, aligning education with industry needs.
- iv. Foster locally developed AI and EdTech solutions products based on African contexts and advantages.
- v. Establish partnerships for policy harmonization, resource mobilization and research

Introduction

Artificial intelligence (AI) has the potential to fundamentally change how universities around the world teach, learn, and conduct research. The use of AI is one of the inevitable key drivers of the 4IR that combines machine learning, deep learning, robotics, and the Internet of Things (IoT) to achieve efficiency and productivity across industries (World Bank, 2023). In Agriculture, AI facilitates precision farming, pest and disease identification, nutrient management, and predictive analytics, whereas in education, it promotes digital literacy and AI-ready talent (FAO and ITU, 2024).

AI can play a significant role in the development of Africa. Home-grown AI solutions are already improving crop protection, livestock management, and tourism monitoring (RUFORUM, 2025). Nevertheless, the continent continues to face challenges such as the inadequate infrastructure, low digital literacy levels, a shortage of AI-skilled professionals, and immature regulatory frameworks (OECD, 2022).

On 3rd December 2025, in Gaborone, Botswana, RUFORUM organized the forum on Artificial Intelligence, Data Science, and Emerging Technologies, to discuss these opportunities and challenges and identify actionable strategies that universities and governments could undertake to leverage AI for inclusive development (RUFORUM, 2025).

Problem Description

African higher agricultural education faces a critical two-fold challenge of leveraging emerging digital technologies to improve learning, teaching and research and mitigating equity, ethics, and capacity risks. Digital transformation can widen existing gaps in educational access and quality, eventually reducing the role of agriculture in Africa's development if no proactive policy measures are implemented.

Although AI and data science have such transformative potential, there are a number of barriers to successful adoption:

- I. Infrastructure and Resource Constraints: inadequate digital infrastructure, such as unreliable electricity, poor internet access, and inadequate hardware, limits the deployment of advanced technologies, especially in rural and agricultural contexts.
- II. Human Capacity and Talent Gaps: There is a notable shortage of AI-skilled personnel and digital fluency is not yet integrated into mainstream curricula. This is also compounded by Africa's inability to retain the best technical talent.
- III. Governance and Ethical Risks: Weak policy frameworks expose the continent to data sovereignty risks, algorithmic bias, and intellectual property challenges (OECD, 2022). Moreover, a lack of access to AI tools among extensionists limits the smallholder farmers' transition to precision agriculture and predictive analytics.
- IV. Stagnant Innovation Ecosystems: Underdeveloped research environments and inadequate collaboration among universities, industry, and government hinder the development of locally-grown, context-specific digital solutions.

All these systemic challenges slow the adoption of modern data-driven tools, decreasing Africa's potential to attain food security, climate resilience, and sustainable economic growth.

Policy Options

Three policy pathways are available for advancing AI and emerging technologies in African higher education:

1. Maintaining the status quo with minimal intervention would continue current practices without strategic AI integration, likely resulting in slow digital adoption, limited productivity gains, and widening digital divides and income inequality. Therefore, there is an urgent need to increase the scale, scope and investment for this strategic integration.
2. A second option is national-level initiatives, where individual universities and countries develop AI curricula, research projects, and technology interventions. While this can generate positive localized impact, it suffers from limited scalability, coordination, and cross-university knowledge sharing. The recommended approach is the establishment of a RUFORUM-led continental AI and Emerging Technologies Network, which would coordinate curricula reform, research programs, infrastructure development, and ethical frameworks, while fostering cross-country collaboration, public-private partnerships, and homegrown AI solutions tailored to African contexts and benefit.
3. The third option is to invest in and effectively utilize the continent's existing human capital to reduce the export of scarce skills. Achieving this requires strong political will and deliberate, strategic investment.

These pathways promise scalable, sustainable, and inclusive AI adoption across agriculture, education, and research in Africa.

Key Recommendations

These key actions should be taken:

1. Curriculum review and Capacity Development: Review curriculum and integrate AI, machine learning, data science, and IoT principles as core components across university academic programs.
2. Continuous Professional Development: Implement lifelong learning programs for faculty and students to ensure adaptability to rapidly evolving AI technologies and leverage on existing human capital skills.
3. Homegrown AI Solutions: Promote AI applications addressing local agricultural, environmental, and educational challenges (e.g., crop monitoring, pest detection).
4. Ethical and Governance Frameworks: Create ethics committees dedicated to overseeing the development and implementation of AI-related policies and guidelines (data sovereignty and data protection, intellectual property, responsible AI use).
5. Infrastructure and Digital Access: Invest in rural connectivity, energy solutions, and hardware to support AI deployment.
6. Research and Innovation Partnerships: Forge strategic industry partnerships to bring cutting-edge tech and data into the classroom and scale AI applications and knowledge transfer.

Action Framework and Conclusion

Without coordinated action, capacity building, and ethical frameworks in Artificial intelligence, data science, and emerging technologies, we risk exacerbating inequalities and underutilization.

RUFORUM and its partners are uniquely positioned and ready to lead continental efforts to harness AI for inclusive development, building Africa's human capital for the 21st century, supporting self-reliance, food security, for sustainable economic growth for Africa to benefit fully from the AI revolution.

References

- FAO and ITU. 2024. Digital Agriculture and Emerging Technologies in Africa. Rome: FAO.
- OECD. 2022. Artificial Intelligence in Agriculture and Ethical Guidelines. Paris: OECD Publishing.
- Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). 2025. Report: Artificial Intelligence, Data Science, and Emerging Technologies. 21st RUFORUM Annual General Meeting (AGM), Botswana.
- World Bank. 2023. Harnessing Artificial Intelligence for Agriculture in Africa. Washington DC: World Bank.