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A Review of Africa's Paths for Inclusive Innovation in Indigenous Knowledge Systems and Artificial Intelligence

Olumayowa Joseph Iyanda[1], Iretiayo Adelaiye[2], Ayomide Afolabi[3], Victory Adelaiye[4]

Institute of Agricultural Value Chain Development and Food Security, Department of Agricultural Sciences, Afe Babalola University, Ado-Ekiti, Nigeria. Email: iyandamayojo@abuad.edu.ng
Department of Human Nutrition and Dietetics, College of Medicine and Health Sciences, Afe Babalola University, Nigeria, adelaiyeiretiayo2020@gmail.com
Department of Plant Science, University of Cambridge, Downing Street, Cambridge, CB2 3EA, United Kingdom, aea52@cam.ac.uk and
College of Law, Afe Babalola University, Nigeria adelaiyeseyi@gmail.com

Corresponding Author: iyandamayojo@abuad.edu.ng

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Abstract

Across the world, emerging technologies and artificial intelligence (AI) are transforming governance, agriculture, healthcare, and education. However, the widespread adoption of such innovations in Africa is often constrained by socioeconomic, cultural, and infrastructural barriers. This review explores the relationship between AI and Indigenous Knowledge Systems (IKS) as a pathway towards inclusive innovation suited to African realities. Drawing upon case studies, policy reports, and peer-reviewed literature, it examines the application of AI in digital learning, telemedicine, diagnostics, and climate-smart agriculture. The integration of IKS aims to enhance sustainability, cultural relevance, and community ownership of AI-driven initiatives. Ethical issues such as algorithmic bias, data governance, and regulatory challenges are critically examined, particularly in relation to marginalised populations. The paper highlights opportunities to employ IKS in creating transparent, participatory, and socially responsive AI frameworks. It concludes with strategic recommendations for embedding AI into African innovation ecosystems through policy alignment, community-led research, and digital skills development. The study argues that combining AI and IKS can bridge the divide between traditional knowledge and modern informatics, fostering sustainable, equitable, and context-sensitive development across Africa.

Keywords: Artificial intelligence, Indigenous knowledge systems, Inclusive innovation, Digital skills, Ethical AI, Africa, Sustainable development

1. Introduction

Background: Growing role of AI in global development.

Artificial intelligence (AI) is one of the most revolutionary technological developments of the twenty-first century (Sun *et al*., 2024). AI-driven tools are increasingly shaping how societies generate knowledge, make decisions, and deliver services across various sectors, including healthcare, finance, education, agriculture, and environmental management. The global uptake of AI continues to expand, as industries adopt it to enhance productivity, optimise resources, and provide customised solutions. In the Global North, AI is widely utilised in precision agriculture, intelligent transport systems, smart healthcare, and renewable energy optimisation. These advancements illustrate that, when effectively deployed, AI can accelerate progress towards sustainable development. Nevertheless, the application and distribution of AI remain uneven worldwide. While regions with robust infrastructures, financial resources, and digital ecosystems experience faster adoption, many developing countries particularly in Africa continue to face structural challenges that hinder effective AI deployment.

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The African Context: Infrastructural Gaps, Digital Divide, Socio-Cultural Realities

The transformative potential of artificial intelligence (AI) is particularly significant within the African context, yet it also presents several challenges. Africa's vast cultural, linguistic, and ecological diversity offers both opportunities and constraints for technological integration (Darwin *et al*., 2024). On the one hand, the continent holds immense potential for innovation owing to its youthful population, expanding digital economy, and strong traditions of communal knowledge exchange. However, infrastructural deficiencies remain a major impediment. In many parts of sub-Saharan Africa, electricity supply is unreliable, internet penetration rates vary widely, and access to digital technology is restricted by the high cost of devices. These infrastructural gaps exacerbate the digital divide, creating inequalities in who can access, utilise, and benefit from AI-driven systems (Table 2). Furthermore, sociocultural realities such as multilingualism, traditional governance structures, and deeply rooted Indigenous Knowledge Systems (IKS) necessitate a rethinking of conventional AI deployment models. When AI systems trained predominantly on Western datasets fail to capture African realities, they risk producing mismatches and exclusions.

Importance of Indigenous Knowledge Systems (IKS) in Addressing African Community Needs

African cultures place great importance on Indigenous Knowledge Systems (IKS), which serve as valuable frameworks for contextualising innovation. Indigenous knowledge encompasses the skills, traditions, and cultural wisdom that communities have accumulated over generations, often through close interaction with their natural environments. For instance, African farmers have long relied on ecological indicators such as plant flowering and bird behaviour to forecast rainfall patterns and seasonal variations in agriculture (Tirivangasi and Kontinen, 2025). Traditional medicine, based on locally available plant-based remedies, continues to provide healthcare for millions, particularly in marginalised and rural communities. Local populations also apply indigenous ecological knowledge to conserve biodiversity and manage natural resources sustainably. These knowledge systems are not only culturally embedded but also represent adaptive strategies that have endured social, economic, and climatic challenges. Recognising and integrating IKS into modern technological frameworks is, therefore, a strategic means of developing solutions that are socially inclusive, broadly accepted, and locally relevant beyond mere cultural preservation.

Problem Statement: AI Risks Exclusion if not Adapted to African Contexts

A promising pathway for inclusive innovation in Africa lies in the integration of artificial intelligence (AI) with traditional knowledge. Inclusive innovation refers to processes of technological development that deliberately aim to address social inequalities, engage marginalised communities, and ensure that the benefits of technology are equitably shared. However, if not properly adapted, AI can inadvertently reinforce exclusion. Most AI systems in operation today are developed using datasets, algorithms, and assumptions rooted in high-income countries (Khan *et al*., 2024). This presents several challenges for African societies. Firstly, the absence of indigenous perspectives may render AI systems ineffective or irrelevant when applied within African contexts. For example, climate prediction models that fail to incorporate indigenous ecological indicators may deliver inaccurate forecasts to local farmers. Moreover, the dominance of non-African datasets in AI research raises ethical concerns regarding bias, representation, and fairness. Unbalanced training datasets, for instance, have been shown to cause facial recognition systems to perform less accurately for darker skin tones, leading to discriminatory outcomes. In the end, AI runs the risk of sustaining a new kind of digital colonialism in which outside technologies take over local ecosystems without giving communities the ability to envision and direct their own technological futures if deliberate adaptation is not made. The challenge, therefore, does not lie in the adoption of artificial intelligence (AI) itself, but in how it is conceptualised, developed, and implemented within African contexts. For AI to truly foster inclusive development, it must engage meaningfully with Indigenous Knowledge Systems (IKS). Incorporating IKS enables AI to become more socially equitable, environmentally adaptive, and culturally sensitive. For instance, integrating databases derived from traditional medicine could strengthen AI applications in healthcare by embedding locally relevant insights alongside biomedical data. Likewise, combining indigenous climate forecasting methods with satellite imagery and predictive algorithms could improve AI-driven

agricultural advisory systems (Kumari *et al*., 2025). In this way, indigenous knowledge not only enhances the cultural relevance of AI solutions but also contributes to community resilience and sustainable development.

To promote inclusive innovation across Africa, this review paper seeks to critically analyse the potential of integrating Artificial Intelligence (AI) with Indigenous Knowledge Systems (IKS). Specifically, the study synthesises existing evidence from peer-reviewed literature, case studies, and policy documents to examine how AI has been applied in key sectors such as healthcare, education, agriculture, and environmental management. It discusses both the opportunities and challenges associated with merging AI and IKS, while emphasising the vital role that indigenous knowledge plays in developing contextually appropriate solutions. Furthermore, the review explores ethical and governance concerns including algorithmic bias, data sovereignty, and regulatory frameworks to ensure that AI-driven innovations remain inclusive and beneficial to all segments of society. By presenting a comprehensive synthesis, this study provides researchers, policymakers, and practitioners with a strategic framework for leveraging the synergies between AI and traditional knowledge to advance sustainable development in Africa (Ncube and Ngulube, 2024).

Paper Organization

To promote coherence and clarity, the paper is organised into several sections. Following this introduction is the methodology section, which outlines the review process and the criteria used to select relevant studies and sources. The results section presents a synthesis of findings from the literature, focusing on key themes such as healthcare, education, agriculture, and the integration of Indigenous Knowledge Systems (IKS). The discussion section interprets these findings, identifying common trends as well as major challenges and opportunities for inclusive innovation. The conclusion summarises the review's key insights and provides strategic recommendations for future research, policy, and practice. Finally, the acknowledgements and references are included to ensure transparency and academic integrity. In this way, the paper not only contributes to scholarly discourse but also offers practical guidance for advancing Africa's innovation ecosystem in a manner that is both technologically advanced and culturally grounded.

2. Methods, Techniques, and Sources

The methodology adopted for this review was designed to ensure a comprehensive and structured synthesis of the literature situated at the intersection of inclusive innovation, Indigenous Knowledge Systems (IKS), and Artificial Intelligence (AI) within African contexts. A scoping review approach was employed rather than a conventional systematic review due to the emerging yet multidisciplinary nature of the subject area. A scoping review is particularly appropriate for mapping key concepts, identifying gaps in the existing literature, and summarising available evidence without necessarily conducting a narrowly focused assessment of intervention effectiveness. This approach allowed for the inclusion of a diverse range of sources, encompassing peer-reviewed journal articles, policy reports, institutional publications, and case studies drawn from across the African continent.

Review Methodology

A guiding research question was formulated at the outset of the review process: *How have AI applications been employed within African contexts, and to what extent have they integrated or engaged with Indigenous Knowledge Systems (IKS) to foster inclusive innovation?* This question was intentionally broad, allowing for the exploration of diverse sectors such as healthcare, agriculture, education, environmental management, and governance, while maintaining a central focus on the interactions between AI, IKS, and inclusivity. The conceptual framework underpinning the review was structured around three interrelated dimensions: (1) the technological dimension, encompassing AI tools and applications; (2) the socio-cultural dimension, focusing on indigenous knowledge and community-based practices; and (3) the development dimension, which prioritised sustainability, equity, and inclusion.

Inclusion Criteria: African-Based Applications of AI, IKS Integration, Inclusive Innovation Frameworks

The inclusion and exclusion criteria were clearly defined to ensure transparency and rigour. Studies and documents were included based on the following conditions: (a) they described AI applications within Africa, whether through pilot projects, national initiatives, or academic research; (b) they directly incorporated Indigenous Knowledge Systems (IKS) in areas such as healthcare, agriculture, environmental monitoring, or education, or addressed the cultural adaptation of technology to local contexts; and (c) they examined inclusive innovation, defined as innovation processes that seek to address inequities and extend benefits to marginalised populations. Sources that discussed indigenous knowledge solely from an anthropological perspective, without reference to informatics, technology, or innovation, or that focused exclusively on AI developments outside Africa without contextual relevance, were excluded.

Databases Searched

A comprehensive search was conducted across several databases and platforms. The peer-reviewed literature search focused on major academic databases such as Google Scholar, Web of Science, and Scopus. Scopus and Web of Science were particularly valuable as they index interdisciplinary research and include a wide range of international journals. These databases were complemented by Google Scholar, which provided access to a broader spectrum of grey literature including conference proceedings, technical reports, and working papers resources that are particularly relevant for emerging fields such as artificial intelligence in Africa, yet are often underrepresented in traditional databases. In addition, targeted searches were undertaken in specialised repositories managed by regional and global organisations, including the Food and Agriculture Organization (FAO), the World Health Organization (WHO), the United Nations (UN), and the African Union (AU). These sources offered valuable case studies, strategic frameworks, and policy documents concerning the integration of indigenous knowledge and the adoption of AI across Africa.

Boolean operators and keywords were combined during the search process to maximise coverage while maintaining specificity. Examples of search terms included: “Artificial Intelligence” AND “Africa” AND “Indigenous Knowledge”; “AI applications” AND “traditional knowledge” AND “inclusive innovation”; “machine learning” AND “African agriculture” AND “local knowledge”; and “AI ethics” AND “Africa” AND “cultural context”. Synonyms and related terms such as “digital technologies”, “informatics systems”, “traditional medicine”, and “community innovation” were also incorporated. Iterative searches were conducted, and the results were screened for relevance based on titles and abstracts prior to full-text retrieval. To identify additional sources, backward snowballing was employed by reviewing the reference lists of relevant publications.

Time Frame Considered

The time frame of the review was deliberately selected to encompass both recent developments in artificial intelligence (AI) and the broader historical evolution of research on Indigenous Knowledge Systems (IKS). Owing to the growing recognition of AI applications across the African continent, most of the relevant literature was published within the past fifteen years (2010–2025). This period coincides with the widespread adoption of mobile technologies, increased internet penetration, and the rapid emergence of innovation hubs in Africa all of which have contributed to the growth of AI-based solutions. However, literature on indigenous knowledge was not confined to this period, as IKS has been studied extensively over several decades and continues to offer valuable insights into community practices. Consequently, seminal works from the 1980s and 1990s were included where they provided relevant frameworks for understanding local adaptation, cultural acceptance, and knowledge transfer.

The screening process was conducted in three stages. First, the search results were examined to remove duplicate entries and irrelevant sources. Second, executive summaries and abstracts were reviewed to determine whether each study met the established inclusion criteria. Finally, a full-text analysis was performed on the selected works to extract detailed information into a structured data extraction sheet. The extraction focused on several key factors: type of publication, year of publication, country or region of study, sector of application (healthcare, agriculture, education, environment, or governance), AI technique or tool employed (such as computer vision, natural language processing, or machine learning), nature of Indigenous Knowledge (IK) integration (including traditional medicine, local

forecasting, or cultural practices), and relevance to inclusive innovation (equity, accessibility, and community participation).

The review recognised the importance of incorporating not only peer-reviewed literature but also grey literature, policy frameworks, and case studies, given the interdisciplinary nature of the topic. Strategic documents on digital transformation and AI adoption produced by African governments and regional organisations such as the African Union's Continental Strategy on Artificial Intelligence and national AI strategies developed in countries including Rwanda, Nigeria, and Egypt provided valuable insights. These documents illuminate how policymakers perceive AI's role in driving development and the extent to which official planning integrates Indigenous Knowledge Systems (IKS). Similarly, reports from research think tanks and non-governmental organisations offered informative case studies of community-driven AI applications, particularly in the areas of health and agriculture. By synthesising both academic and grey literature, the review sought to bridge the gap between theoretical perspectives and real-world practice.

Findings from diverse sources were analysed and integrated using a qualitative synthesis approach to enhance reliability. Rather than conducting a meta-analysis which requires quantitative comparability across studies the review employed thematic coding to identify recurring themes, key challenges, and emerging opportunities. Data were inductively coded to capture issues such as policy frameworks, ethical considerations, and the integration of Indigenous Knowledge Systems (IKS) within sectors including healthcare, education, and agriculture. Thematic synthesis enabled the mapping of relationships among these themes, revealing areas of overlap as well as points of divergence. A significant research and practice gap was identified; for instance, while several studies highlighted the potential of AI to improve diagnostic accuracy in healthcare, few specifically examined the digitisation or integration of indigenous medical knowledge.

Transparency was maintained in documenting the search strategies, databases consulted, and inclusion criteria to ensure the credibility of the review process. One of the acknowledged limitations was the possibility that certain relevant innovations originating in Africa may not have been published in indexed journals or made publicly available through accessible repositories. Local innovations, particularly those emerging from grassroots communities, may exist only in internal project reports or remain undocumented. To mitigate this limitation, priority was given to outreach involving institutional repositories, open-access platforms, and regional conference proceedings. Nevertheless, the review recognises that the field is dynamic and rapidly evolving, and that new evidence will continue to emerge beyond the scope of this study.

The methodological approach adopted in this review ensured the inclusion of a wide range of multidisciplinary sources by combining the analytical depth of thematic synthesis with the comprehensive scope of a scoping review. To address the guiding research question, the review developed a robust body of evidence focused on inclusive innovation frameworks, the integration of Indigenous Knowledge Systems (IKS), and AI applications grounded in African contexts. The use of multiple databases, complementary grey literature, and a fifteen-year time frame for AI studies ensured the documentation of both recent technological developments and enduring indigenous practices. This rigorous methodological foundation underpins the subsequent results and discussion sections, which explore in depth the interplay between AI, indigenous knowledge, and inclusive innovation across Africa.

3. Results

The literature reviewed for this study reveals a diverse range of themes relating to the application of Artificial Intelligence (AI) in Africa and its potential integration with Indigenous Knowledge Systems (IKS). These themes underscore the ethical, policy, and governance considerations that accompany such interventions, while also illustrating the transformative potential of AI across key development sectors such as healthcare, education, agriculture, and environmental management. The review further demonstrates that African Indigenous Knowledge rooted in centuries of ecological understanding, cultural experience, and community-based practices constitutes a rich repository of insight capable of informing more sustainable and inclusive innovation pathways.

Table 1: Summary of AI and IKS Integration across Key Development Sectors in Africa

Sector	Examples of AI Application	Role of Indigenous Knowledge	Challenges	Inclusive Innovation Opportunities
Healthcare	AI-driven diagnostics, telemedicine, disease surveillance	Traditional medicine databases, community health practices	Infrastructure, affordability, regulatory gaps	Integrating AI diagnostics with traditional health networks
Education	Adaptive learning platforms, virtual tutoring	Oral knowledge transfer, local pedagogy, storytelling	Language barriers, low digital literacy	Localized AI-based EdTech supporting indigenous languages
Agriculture	Precision farming, pest/disease detection, climate prediction	Traditional ecological indicators, organic soil management	Model transferability, cost	Hybrid AI–IKS advisory systems for smallholders
Environment	Climate modelling, early-warning systems	Indigenous weather forecasting, biodiversity knowledge	Lack of localized data, policy inconsistency	AI models trained with indigenous environmental datasets
Governance and Ethics	Data governance, AI policy frameworks	Communal ownership ethics, participatory decision-making	Weak regulation, data exploitation	Culturally grounded AI ethics and policy design

Table 2: Barriers and enablers shaping the integration of AI and IKS for inclusive African innovation

Category	Barriers	Enablers
Policy	Fragmented AI regulations, weak data-protection laws	African Union Digital Transformation Strategy; national AI frameworks
Funding	Low R&D investment, reliance on foreign donors	Public–private partnerships; local innovation grants
Infrastructure	Power instability, poor connectivity	Growing broadband penetration; renewable-energy initiatives
Human Capacity	Limited AI expertise, low digital literacy	Expanding STEM education; community-based digital-literacy programmes
Cultural and Ethical Context	Bias in imported AI systems, digital colonialism	Indigenous data sovereignty; participatory technology design

3.1 AI in Healthcare and Public Health

Healthcare is one of the most prominent sectors in Africa where Artificial Intelligence (AI) applications have been tested and promoted (Oladipo *et al*., 2024). For example, AI-powered diagnostic tools are increasingly being used to assist in the early detection of diseases such as HIV/AIDS, tuberculosis, and malaria, which continue to have a significant impact on African populations. Algorithms capable of analysing clinical records, blood samples, and medical images have been shown to improve diagnostic accuracy, particularly in regions where medical professionals are scarce. AI-enhanced telemedicine platforms have also facilitated remote consultations, overcoming geographical barriers for rural populations that often lack access to clinics and hospitals. Furthermore, mobile applications and wearable health technologies now enable continuous patient monitoring, generating real-time data that support early intervention and preventive care.

Despite these promising advancements, the literature identifies several key gaps that hinder the widespread adoption of Artificial Intelligence (AI) in healthcare across Africa. Inadequate infrastructure such as unreliable electricity supply and limited internet connectivity, both essential for the effective operation of digital technologies continues to leave rural communities disproportionately underserved (Chisika and Yeom, 2024). Affordability presents another persistent challenge: although AI-powered diagnostic tools may reduce costs over time, many healthcare institutions and individuals are unable to meet the high initial expenses associated with implementation. In addition, cultural factors such as scepticism towards new digital tools and the continued reliance on traditional healers further slow adoption in some communities. These disparities underscore the importance of integrating AI-driven approaches with traditional healing practices to develop healthcare solutions that are culturally appropriate, economically feasible, and contextually relevant.

3.2 AI in Education and Skills Development

Another key theme that emerges from the literature is the growing influence of Artificial Intelligence (AI) on education and skills development across Africa. AI-driven educational technology platforms are increasingly being introduced to personalise learning experiences (Ayeni et al., 2024). For example, adaptive learning systems are designed to assess student performance in real time and adjust course content according to individual learning needs. This approach enables more tailored instruction that helps to address knowledge gaps and promotes deeper learner engagement. Additionally, AI is being employed to streamline administrative processes such as admissions and grading, thereby reducing the workload of already overburdened teachers.

Beyond formal education, AI-enabled platforms are supporting coding boot camps, virtual mentorship programmes, and digital skills training initiatives designed to equip African youth with the competencies required for the Fourth Industrial Revolution. Research indicates that Artificial Intelligence (AI) has a significant impact on STEM education through the use of interactive simulations, language translation tools, and real-time problem-solving applications (Nawaz, 2024). These innovations are crucial in narrowing the achievement gaps between students in underserved communities and those in well-resourced schools, as well as between learners in urban and rural areas.

Despite the promise of AI in education, there are still major obstacles to overcome within the African context. A common challenge is the fundamental mismatch between the skills offered by current AI-enabled education platforms and the actual demands of African labour markets. Effective adoption is further hampered by the low levels of digital literacy that persist among both educators and learners, preventing seamless integration and use. Furthermore, while these AI platforms typically provide content in international languages like English and French, they frequently fall short in supporting local African languages. This failure to be linguistically inclusive risks alienating a significant portion of the population (Lin, 2024). Ultimately, if AI is not purposefully integrated with indigenous educational practices such as storytelling and group learning it has the potential to worsen rather than lessen current disparities, making a culturally sensitive approach absolutely critical (Table 1).

3.3 AI in Agriculture and Environment

Since many African economies continue to rely heavily on agriculture, AI offers significant potential to substantially enhance food security and ensure sustainable livelihoods across the continent (Table 1). This is supported by extensive documentation in the literature detailing various applications of AI to agricultural development. For instance, precision farming methods are already employing sophisticated AI algorithms to optimise critical processes such as pest control, the application of fertilisers, and irrigation schedules. This algorithmic optimisation simultaneously increases crop yields while crucially decreasing resource waste. In a similar vein, AI is being utilised in advanced climate prediction models that are proving essential. These models provide smallholder farmers with early alerts concerning pest outbreaks, floods, and droughts, enabling them to take timely preventative action (Delfani *et al*., 2024). Furthermore, the early detection of crop diseases and pest infestations achieved through technologies like drones and AI-enabled imaging is helping farmers avert otherwise significant losses.

Even with the promising advantages of AI, the technology's adoption in Africa's agricultural context remains uneven. The fundamental problem, according to a recent review, is that many AI-driven agricultural models are imported from outside of Africa and consequently fail to account for the specific socioeconomic, cultural, and environmental conditions prevalent there. This lack of contextualisation is particularly evident as these models often focus narrowly on monoculture and high-input farming systems. As a result, they frequently overlook indigenous practices crucial to African farming, such as intercropping, mixed farming, and the use of organic soil amendments. Since African farming communities have relied on traditional ecological knowledge for generations, this inherent disconnect runs the serious risk of marginalising this tried-and-true knowledge base. Therefore, to genuinely increase AI's impact, indigenous knowledge must be methodically incorporated into digital farming platforms. The goal is to build hybrid models that effectively combine cutting-edge technology with time-honoured local methods (Khanan *et al*., 2024).

3.4 Integration of Indigenous Knowledge Systems (IKS)

The idea that Indigenous Knowledge Systems (IKS) are not merely historical records but offer a crucial supplement to AI-driven innovation is a recurring and highly important theme in contemporary literature. Various case studies have demonstrated exactly how integrating IKS can significantly improve the cultural acceptability, sustainability, and local ownership of new technological solutions. A clear example comes from the medical field. Here, significant efforts have gone into developing digital databases of traditional medicinal plants and practices, many of which are now undergoing rigorous scientific verification (Li *et al*., 2025). Importantly, AI algorithms are being actively employed to examine these extensive databases for potential pharmacological uses, effectively serving to bridge the gap between conventional medicine and contemporary biomedical science. This approach highlights the vital benefit of creating hybrid models that both respect and systematically leverage deep traditional wisdom alongside cutting-edge technology.

Communities have long used indigenous forecasting techniques in environmental management to predict seasonal weather patterns (Table 1). These methods involve observing natural indicators, such as studying plant phenology, animal behaviour, or atmospheric changes. By systematically combining such time-honoured techniques with modern AI-powered climate models, the resulting predictive accuracy is significantly enhanced. Crucially, this hybrid approach also increases local communities' trust and adoption of the forecasts. Comparably, in the field of agriculture, AI-based agricultural advisory systems are increasingly being used in conjunction with traditional practices. This includes integrating AI-driven advice with long-established methods like composting for managing soil fertility or the use of botanical extracts to control pests (Aziz *et al*., 2025). This systematic integration demonstrates how local, tried-and-true methods can be leveraged to maximise the impact of cutting-edge AI solutions.

The advantages of integrating Indigenous Knowledge Systems (IKS) with AI are obvious and critical for success. When AI solutions are specifically designed to take into account local knowledge and customs, they become significantly more likely to achieve high rates of adoption by communities and ensure their long-term sustainability. Crucially, this integration fosters a necessary sense of ownership among the communities. They stop viewing AI as an external or "outside" solution, and instead perceive it as a direct outcome of their own valuable contributions to the innovation process (Secundo *et al*., 2025). By upholding local cultural values and methodically incorporating native epistemologies into technological systems, Africa can effectively advance a truly inclusive innovation that accurately reflects its diverse realities (Table 2).

3.5 Ethical, Policy, and Governance Issues

The existing literature strongly emphasises that broader ethical, policy, and governance issues are inextricably linked to the successful adoption of AI in African societies (Walter, 2024). A particularly pressing issue is algorithmic bias, which can lead to significant injustices and inaccuracies when applied locally, primarily because many current AI systems are trained using datasets from non-African contexts. This data imbalance has serious practical repercussions. For example, healthcare algorithms may fail to accurately detect diseases common in African populations because they are underrepresented in the training data. Similarly, facial recognition technologies have already been demonstrated to perform poorly and unreliably on darker skin tones. Addressing this fundamental data deficit and establishing robust regulatory frameworks are essential for mitigating these biases and ensuring the equitable integration of AI across the continent (Table 1).

A further, crucial issue tied to AI adoption is data governance. In many African nations, there remain numerous unanswered questions concerning the fundamental principles of data ownership and control, storage practices, and use (Olono *et al*., 2024). In the absence of robust and well-defined regulatory frameworks, there is a severe risk of digital colonialism. This is the scenario where external actors systematically extract and profit from African data with minimal corresponding benefit flowing back to the local populations. This risk is compounded by often weak legal systems and a general lack of the technological capability required effectively monitoring and enforcing existing data protection laws. Establishing clear, local control and sovereignty over data is thus critical for achieving equitable and beneficial AI development.

The risks associated with AI, particularly concerning data exploitation and algorithmic bias, are further intensified by fundamental gaps in governance and policy (Table 2). Although pan-continental initiatives, such as the African Union's Digital Transformation Strategy, provide some broad guidance, national-level policies are still often disjointed and frequently prove insufficient in addressing the particular ethical implications of AI within local contexts. The literature issues a strong caution that if these critical governance and policy gaps are not effectively filled, AI is likely to exacerbate existing inequality and perpetuate patterns of exploitation, rather than delivering on its promise of encouraging inclusive innovation (Dinker, 2024). Therefore, cohesive and contextually relevant national policies are an essential foundation for equitable and beneficial AI integration.

4. Discussion

The African literature on AI and Indigenous Knowledge Systems (IKS) is currently being synthesised with the aim of clearly revealing both the technology's transformative potential and the systemic constraints that actively influence the path toward inclusive innovation across the continent. Rather than simply restating the factual research results, the discussion is primarily focused on examining their wider implications within the crucial social, cultural, and policy spheres. This approach allows for a deeper understanding of how the integration of AI and IKS impacts African societies at the fundamental regulatory and cultural levels.

The potential for AI to completely transform healthcare, education, and agriculture in Africa is entirely dependent on how well it fits with regional epistemologies (ways of knowing). Technologies that are merely imported from other areas frequently fail because of their inherent disregard for local values, linguistic diversity, and ecological customs (Stahl and Eke, 2024). Thus, successful innovation necessitates the incorporation of indigenous viewpoints that strengthen the technology's legitimacy and local ownership. Adoption and long-term sustainability increase significantly when communities perceive AI not as an outside force, but rather as an extension of their existing knowledge and practices.

The crucial synergies between AI and Indigenous Knowledge Systems (IKS) make co-produced innovation possible a participatory model where communities actively assist in designing and adapting digital tools. This integration offers tangible benefits: for instance, digitalised traditional medicine repositories can validate indigenous healthcare knowledge, and local rainfall prediction indicators can meaningfully inform AI-based climate models (Ukoba *et al*., 2025). In doing so, these efforts directly challenge prevailing narratives of digital colonialism and establish Africa as a source of epistemic innovation by successfully bridging the gap between data-driven systems and deep cultural experience (Muwanga-Zake and Kibukamusoke, 2024).

The necessity and benefits of integrating AI with Indigenous Knowledge Systems (IKS) are strongly supported by comparative experiences from Asia and Latin America. In these regions, success is consistently determined by the presence of robust policy frameworks and institutional support. This is clearly evidenced by successful partnerships that integrate digital tools with indigenous agriculture in the Andes and the AI-driven analysis of Ayurvedic medicine in India (Viera-Arroyo *et al*., 2025; Noguera *et al*., 2025). Africa's unique strength in this context is its dynamic, living traditions, where local knowledge still profoundly influences daily life (Mawere and Mukonza, 2025). Utilising this inherent cultural vibrancy can effectively help to shape hybrid innovation models that are appropriate and sustainable for regional contexts.

There are still enduring obstacles hindering the successful integration of AI and Indigenous Knowledge Systems (IKS). Attempts at integration are significantly hampered by the persistent digital divide, inadequate funding, and weak regulatory frameworks (Khazbak *et al*., 2025). Specifically, many countries lack comprehensive data protection regulations and enforceable AI policies. Furthermore, sustainability is severely limited by a general lack of domestic funding, a heavy reliance on outside funding, and a lack of appreciation for domestic research efforts (Chigwada and Ngulube, 2025). Additionally, the existing challenges of low literacy and poor digital infrastructure run the serious risk of making inequality worse rather than improving it (Mwansa *et al*., 2025).

Despite the enduring challenges, new opportunities are encouraging. Participatory design has been shown to be particularly beneficial in community-driven AI projects, such as the creation of digital

medicinal plant herbariums or farmer-generated datasets (Ahrweiler *et al*., 2025). Creating localised datasets with a strong African ecological and cultural foundation not only improves inclusion but also significantly enhances accuracy and fairness (Marko *et al*., 2025). Furthermore, for scaling such initiatives, the African Union's Digital Transformation Strategy offers a crucial, unified policy foundation that fosters ethical innovation and cross-border cooperation.

This discussion strongly emphasises that grounded, human-centred strategies are essential to Africa's AI future, particularly those where traditional knowledge and contemporary informatics co-evolve. By giving priority to contextual knowledge, inclusivity, and policy coherence, the continent is uniquely positioned to lead the way in developing a distinctive model of sustainable and equitable technological transformation. This approach ensures that AI is built upon, and serves, the specific cultural and social realities of African societies.

5. Conclusion

Summary of findings

This review set out to investigate the ways in which Indigenous Knowledge Systems (IKS) and artificial intelligence (AI) can be effectively combined to promote inclusive innovation in Africa. The review, which was based on an analysis of case studies, policy documents, and peer-reviewed literature, found that although AI is being used more and more in vital fields like healthcare, education, agriculture, and environmental management, its long-term viability in Africa will fundamentally depend on how well it meshes with local realities. Since indigenous knowledge is based on centuries of experiential learning and cultural practice, it provides an essential counterbalance to the dangers of universally applicable, externally imposed technological solutions. Thus, integrating AI with IKS is not only desirable but also necessary in order to achieve sustainable, culturally appropriate, and equitable innovation outcomes throughout the continent.

Contribution of AI + IKS integration to Africa’s Innovation Ecosystem

The first of three major strands used to summarise the review's results focuses on AI's great deal of promise for increasing both service accessibility and productivity in vital development areas. The potential of the technology to address structural deficiencies is clearly evident in fields such as farming, encompassing precision agriculture and climate prediction models, and in healthcare, with the use of AI-enabled diagnostics and telemedicine platforms. However, evidence also points to the unequal distribution of these innovations. They are frequently restricted to elite institutions or urban areas, consequently leaving rural and marginalised communities behind.

Secondly, it becomes clear that the use of indigenous knowledge is essential to guaranteeing the sustainability, cultural legitimacy, and community ownership of artificial intelligence. In African societies, indigenous methods for environmental stewardship, agriculture, and health are still widely accepted and used. AI systems gain the traction and legitimacy that purely external systems frequently lack when they are consciously aligned with these traditions, such as through digitising databases of herbal medicines or incorporating regional ecological indicators into climate models.

Thirdly, there are significant opportunities as well as challenges when it comes to ethical and governance issues. Worries about algorithmic bias, data privacy, and digital colonialism bring to light the dangers of importing AI solutions without contextual adaptation. However, these difficulties also give Africa the chance to lead the way in developing moral frameworks and policy strategies that are based on African realities and values rather than merely being lifted from other areas. By placing a strong focus on regional ethics, the continent may be able to influence the global discussion on responsible AI.

Develop Localized AI Datasets Incorporating IKS

The most significant contribution of this review lies in the compelling example it presents of how the integration of Artificial Intelligence (AI) and Indigenous Knowledge Systems (IKS) can fundamentally transform the African innovation ecosystem. By systematically embedding indigenous knowledge into the design, training, and deployment of AI systems, Africa can cultivate inclusive, culturally grounded, and participatory innovation models. Such integration not only enhances the relevance of AI

applications to local contexts but also challenges dependency narratives by reaffirming Africa's position as a generator of knowledge and innovation in its own right. The hybrid model that emerges from combining advanced computational capability with the richness of local wisdom offers a valuable template for other regions seeking to achieve a balanced relationship between technological progress and cultural heritage.

Strategic action is required in several areas to move from theory to practice. The first recommendation is the creation of localised datasets that incorporate indigenous knowledge. Existing AI models are often trained on datasets derived from non-African contexts, leading to bias, misrepresentation, and reduced predictive accuracy. African scholars and policymakers can create datasets that accurately represent their realities by making investments in the methodical gathering and digitisation of local knowledge, whether it be traditional medical systems, agricultural methods, or cultural taxonomies. Such datasets would not only preserve valuable cultural heritage but also enhance the precision and contextual relevance of AI applications.

Invest In Community-Centered Digital Literacy Programs

The second recommendation is to fund digital literacy initiatives that are community-focused. The success of AI integration depends not only on technically skilled professionals but also on the ability of ordinary people to understand, engage with, and influence these technologies. Therefore, digital literacy programmes should be inclusive, targeting women, young people, and rural populations groups that are often excluded from formal training opportunities. In addition to teaching technical skills, these programmes should highlight the ethical, cultural, and social implications of AI, ensuring that communities become active co-creators of technology rather than passive users.

Establish Ethical AI Policies Rooted In African Contexts

The third recommendation is the creation of ethical AI regulations with an African foundation. Global discussions on responsible AI often concentrate on issues relevant to developed nations, such as automated labour and autonomous weapons. Although these concerns are important, Africa faces distinct challenges, including the risk of digital colonialism, the commercialisation of traditional knowledge, and the deepening of social inequalities caused by biased algorithms. Policymakers must therefore develop regulatory frameworks that directly address these risks while promoting accountability, transparency, and equity. These participatory frameworks should involve not only technical experts but also communities, civil society organisations, and indigenous leaders.

Strengthen Partnerships among Academia, Government, and Industry

The fourth recommendation is to strengthen collaborations between industry, government, and academia. The integration of AI and Indigenous Knowledge Systems (IKS) requires expertise across computer science, anthropology, sociology, agriculture, medicine, and ethics, as it is inherently interdisciplinary (Figure 1). No single institution can advance this agenda independently. Progress can be accelerated through collaborative partnerships that enable knowledge sharing, resource pooling, and alignment of priorities. Universities can conduct research and provide training; governments can offer funding and supportive policies; while industry can scale and commercialise innovations (Table 2). Importantly, indigenous communities should also be integral to these collaborations, as their participation and knowledge are vital to the process.

The future of AI in Africa should be envisioned as one that is sustainability-focused, ethically conscious, and culturally grounded. If current patterns of uncritical technology transfer persist, there is a significant risk that AI could deepen inequalities, erode local knowledge systems, and create new forms of exclusion. However, by strategically combining AI with Indigenous Knowledge Systems (IKS), Africa has the opportunity to establish a new model of development that is inclusive, resilient, and globally distinctive. Such a model would not only address pressing challenges in healthcare, education, and agriculture but also advance broader goals of social justice, environmental sustainability, and cultural preservation.

The outlook is therefore cautiously optimistic. While the challenges remain formidable including weak policy frameworks, limited funding, and inadequate infrastructure Africa also possesses distinct advantages. These include a youthful population eager to embrace technology, vibrant indigenous

traditions, and continental initiatives such as the African Union's Digital Transformation Agenda. If these resources are strategically harnessed, Africa can chart a future in which artificial intelligence (AI) becomes a locally developed tool that complements and reflects the continent's own knowledge systems, rather than serving as an externally imposed solution..

Finally, this review underscores that the question for Africa is not whether to adopt artificial intelligence (AI), but how to do so in a sustainable, ethical, and inclusive way. The integration of AI and Indigenous Knowledge Systems (IKS) provides a solid foundation for addressing this challenge. It offers a pathway towards building an innovation ecosystem that is technologically advanced, culturally grounded, and socially equitable. As Africa prepares for a future increasingly shaped by digital technologies, the synthesis of contemporary informatics with traditional knowledge may well determine whether AI becomes a tool of exclusion or a catalyst for empowerment.

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List of Abbreviations

AI – Artificial Intelligence
IKS – Indigenous Knowledge System
FAO - Food and Agriculture Organisation
WHO - World Health Organisation
UN - United Nations
AU - African Union
ABUAD - Afe Babalola University, Ado-Ekiti

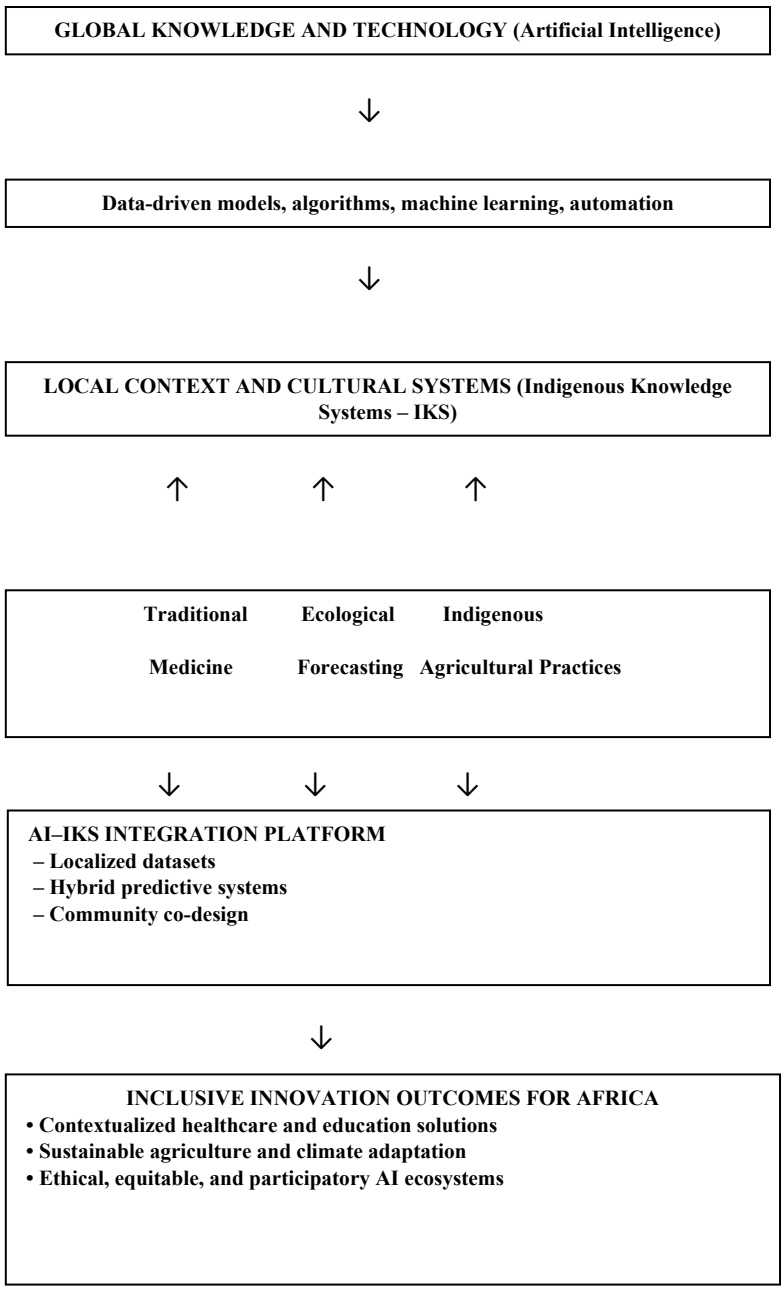


Figure 1: Framework for AI–Indigenous Knowledge Systems Synergy toward Inclusive African Innovation