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Bridging Urban AI and Responsible AI Toward Collective Urban Intelligence: Insights From 14 African Initiatives

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Abstract

Urban artificial intelligence (AI) is emerging as a transformative paradigm redefining how cities process data, make decisions, and address systemic challenges. Yet, in African contexts, AI adoption remains constrained by infrastructural limitations, governance gaps, unequal access to technology, and lack of context-sensitive approaches. This article explores the intersection of urban AI, responsible AI, and collective urban intelligence (CUI) to understand how African initiatives are leveraging AI to foster sustainable, inclusive, and ethical urban transformation processes. Drawing on 14 semi-structured interviews with practitioners, researchers, and entrepreneurs from across the continent, the study maps the current landscape of AI-driven tools and services addressing sectors such as planning, health, agriculture, and education. The findings reveal that African-led AI initiatives are operationalizing key responsible AI principles, showcasing how CUI is promoting distributed intelligence systems where human, institutional, and algorithmic agents co-produce locally relevant urban knowledge.

Keywords

Africa; AI ethics; collective urban intelligence; responsible AI; sustainability; urban AI

1. Introduction

As the fastest-urbanizing continent, Africa's urban population is expected to double by 2050, with 80% of that increase occurring in cities (Muggah & Hill, 2018). This rapid growth outpaces infrastructural and policy development, heightening the challenge of achieving urban sustainability.

At the same time, urban artificial intelligence (AI) emerged as a field describing AI-enabled systems for cities, representing a new stage of urban digitalization where AI is used to interpret urban data, inform decisions, and operate autonomous systems (Batty, 2023), given its data-processing and analytics capacities displaying a wide range of applications in urban planning and public service delivery (Plantinga et al., 2024). Particularly in resource-constrained contexts, AI presents multiple opportunities (Adejuwon, 2025). These include applications in education (Kiemde & Kora, 2022), traffic management (Olayode et al., 2020), healthcare (Owoyemi et al., 2020), and agriculture (Foster et al., 2023; Jellason et al., 2021). Indeed, African cities and technology providers are turning to AI to overcome infrastructural limitations and advance sustainable development (Wakunuma et al., 2022). AI increasingly supports this goal alignment through optimization and data-driven decision-making (Adio-Moses & Asaolu, 2016; Herath & Mittal, 2022).

Nonetheless, in comparison to other regions, the adoption of AI in Africa is comparatively low due to infrastructural deficiencies, data constraints, systemic disparities, and regulatory shortcomings (Gimpel & McBride, 2023; Isagah & Musabila, 2020; Jaldi, 2023). Alongside its potential benefits, the challenges AI introduces to urban systems and communities are also central to responsible-AI research and governance debates, highlighting accountability, ethical and value-sensitive design, as well as cultural awareness of AI's impacts (Dignum, 2017).

This article addresses a gap in the literature by exploring the landscape of urban AI initiatives in Africa, questioning how urban AI aligns with ongoing urbanization processes and how it intersects with responsible AI in practice. Using the lens of collective urban intelligence (CUI) as a framework, we show how African initiatives are operationalizing key pillars of responsible AI at multiple levels. In doing so, the article shifts the framing of urban AI from a technological paradigm to a socio-technical governance model grounded in collective intelligence.

The article proceeds as follows: Section 2 outlines key conceptual frameworks from urban AI and responsible AI literature; Section 3 describes the methodology; Section 4 presents and discusses the empirical findings; and Section 5 provides final reflections and recommendations for conceptualizing, implementing, and governing responsible urban AI in Africa through a CUI lens.

2. Bridging Urban and Responsible AI: Conceptual Foundations for the African Urban Context

2.1. Digitalizing Cities: Smart Cities and Urban AI

In the literature, urban AI is often discussed in relation to and in contrast with the smart city concept. While the smart city paradigm emphasizes digital integration to enhance efficiency, optimize resources, and enable data-driven governance, urban AI foregrounds the role of algorithmic systems in reshaping infrastructures,

spatial configurations, and everyday urban practices (Luusua et al., 2023). Technocratic and corporate-driven approaches often treat technology as a neutral enabler of urban efficiency, while the neutrality of technologies is highly contested given their political embeddedness in smart city agendas (Batty, 2023; Graham & Marvin, 2002; Ravetz, 2018).

In this sense, does urban AI represent an ontological shift? Caprotti et al. (2024) trace the concept's genealogy not to urban planning but to technologies developed for industrial, military, and logistical purposes, and when embedded in urban contexts, AI emphasizes autonomy, emergence, and iterative learning, moving "from control to autonomy and from optimization to emergence" (Caprotti et al., 2024, p. 885). These systems, originally designed for other contexts, can produce unpredictable outcomes that challenge traditional governance. In this movement of advancing AI-supported governance, CUI proposes moving from technologically optimized "smart" urbanism to "wise" urbanism, which emphasizes collective learning and shared responsibility (Ravetz, 2018).

2.2. Responsible AI and the African Context: A Focus on Ethics, Sustainability, and Governance

Responsible AI underpins stakeholder accountability, ethical and value-sensitive design, and cultural awareness of AI's impacts (Dignum, 2017), framing AI within a broader socio-technical ecosystem (Dignum, 2023) where responsibility is shared, systems align with human values, and cultural contexts guide implementation (Fontes et al., 2024).

Globally, AI integration across sectors has accelerated, yet readiness for adoption does not guarantee responsible deployment, particularly in Africa (Nzobonimpa & Savard, 2023). Limited governmental expertise and inadequate AI training risk leaving Africa behind in the adoption of AI-enabled systems (Butcher et al., 2021; Eke et al., 2023). Moreover, dependence on externally developed AI solutions raises concerns over suitability and embedded biases that may reinforce data inequalities and unfair decision-making (Isagah & Musabila, 2020). Additionally, rapid urbanization, infrastructural fragmentation, and unequal service access mean digital systems often operate alongside or compensate for physical infrastructure gaps (Adejuwon, 2025). While this enables leapfrogging in sectors such as finance and health, it risks reproducing splintering in digital form. The coexistence of formal and informal infrastructures raises critical questions about AI's role in amplifying or mitigating urban inequalities.

Responsible AI requires inclusive approaches addressing both social and technical dimensions. These include the need to detect and mitigate bias, ensuring diverse community representation, and aligning with sustainability goals. The UN's Sustainable Development Goals (SDGs) are a central sustainability framework in the African context (Croese, 2022). Moreover, systems should be context-sensitive where value-alignment requires that African value-systems, such as Ubuntu and Ujamaa, emphasize solidarity and community, and are considered as culturally resonant alternatives to individualistic AI ethics (Amugongo et al., 2023; Dignum, 2023; Ewuoso & Hall, 2019; Gwagwa et al., 2022; Yilma, 2025). Responsible AI calls for goal alignment to advance the UN SDGs, yet the technology's own lifecycle impacts and how they disproportionately impact certain contexts in the African continent are often overlooked (Bolte & van Wynsberghe, 2025; van Wynsberghe, 2021; Wakunuma et al., 2022).

Despite these advances, existing responsible AI frameworks remain largely universalist and insufficiently grounded in the socio-technical realities of African cities. They often assume stable infrastructure, high data availability, and institutional capacity, conditions that do not hold in many contexts examined in this study. This creates a gap between normative frameworks and practical implementation, which this article addresses through the lens of CUI.

2.3. AI Adoption in Africa

An African AI startup ecosystem is gaining traction, particularly in South Africa, Nigeria, Egypt, and Kenya, illustrating growing local innovation supported by research hubs (Gadzala, 2018). The distribution of AI-specialized companies reflects this trend (Figure 1).

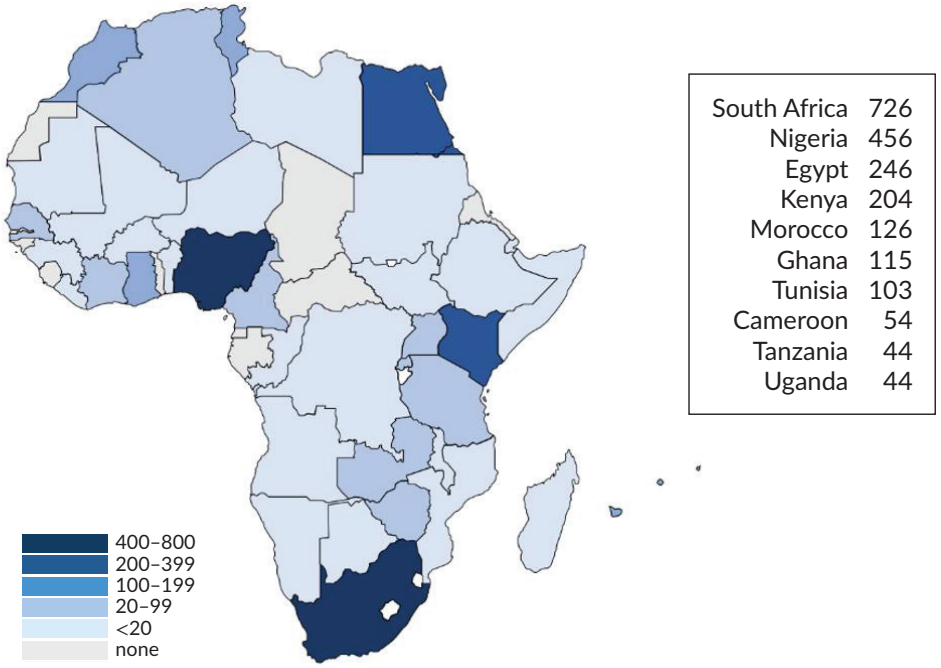

Figure 1. Number of companies specialized in AI in Africa based on LinkedIn data. Source: Own elaboration based on AI Media (2022).

Academic institutions are playing an increasingly vital role in AI research and governance by integrating AI competencies into education and supporting local innovation ecosystems. They underscore the need for stronger collaboration with the private sector and for scaling spin-offs tailored to local needs (Butcher et al., 2021; Omorogiuwa et al., 2023; Sinde et al., 2023).

Regarding governance, the Continental Artificial Intelligence Strategy was launched by the African Union (2024), and by mid-2025, 16 countries had adopted national AI strategies, with 34 having their strategies being developed (Intelpoint, 2025). Regional disparities in AI readiness remain pronounced, with the Government AI Readiness Index 2023 (Hankins et al., 2023) highlighting significant gaps in governance and local capacity between the Middle East and North Africa (MENA) region and sub-Saharan Africa. While Egypt has adopted a Charter for Responsible AI aligned with global standards (OECD, 2024) and Tunisia is developing a national AI strategy, sub-Saharan Africa ranks lowest overall despite notable progress by

countries such as Mauritius, South Africa, Rwanda, Senegal, Benin, Ethiopia, and Nigeria in advancing national AI strategies and AI governance initiatives.

Limited regulatory and governance capacity, particularly at the local government level, creates a gap in adapting AI frameworks to local realities and values, while city-level AI governance remains largely absent, leaving urban areas reliant on national or digital transformation policies (Ben Dhaou et al., 2024). Although many countries have data protection and interoperability frameworks that remain key components of AI governance (Isagah & Ben Dhaou, 2024), spatial and digital divides continue to limit equitable access to AI's benefits, hindering people-centered and responsible AI in urban contexts (Ben Dhaou et al., 2024; UN-Habitat, 2020). Unclear accountability structures, limited community engagement in AI development and monitoring, and low AI awareness among stakeholders, including public-sector decision-makers, further highlight the need for capacity building and stronger communication with local communities (Ben Dhaou et al., 2024; Dignum, 2017, 2023; see also Eke et al., 2023). These challenges underscore the importance of examining how CUI can contribute to operationalizing responsible urban AI in Africa and how local initiatives can shed light on what this process might look like. While existing studies have begun to conceptualize urban AI applications (Hendawy & Ghoz, 2024), there remains limited empirical understanding of how these systems are operationalized in practice within African contexts. In particular, the intersection between urban AI, responsible AI, and locally grounded socio-technical dynamics remains underexplored.

3. Methodology

Despite growing interest in AI for sustainable development in Africa, research remains limited on how urban AI initiatives align with responsible AI. This study examines the landscape of urban AI initiatives in Africa, exploring how urban AI aligns with ongoing urbanization processes and intersects with responsible AI in practice. Using the lens of CUI, we propose a framework that illustrates how African initiatives operationalize key responsible AI pillars at multiple levels. We draw on 14 semi-structured interviews with practitioners from businesses, startups, and universities, structured around four thematic areas (Table 1) to enable comparative, context-sensitive analysis.

Table 1. Interview guide, structured around four thematic areas.

Thematic Areas	Objective	Guiding questions
Motivation and Vision	Understanding the motivation behind the initiatives, i.e., their vision and mission.	What is the vision/mission of your business/project?
Describing Urban AI Initiatives	Exploring specific tools, services, research, and teaching programmes that use AI to address urban challenges in Africa.	What kind of solution do you develop? Where do you apply your developed solution? (i.e., region/country) Who is your target customer or beneficiary? What is the main problem or challenge your business/project is addressing? To what extent do you use AI in your business/project? Briefly describe your AI application: How do you use AI to address your issue/problem/challenge? Why did you decide to use AI to address this problem?

Table 1. (Cont.) Interview guide, structured around four thematic areas.

Thematic Areas	Objective	Guiding questions
Benefits and Challenges of AI	Addressing the dual impacts of AI and identifying specific benefits and challenges.	What are the main benefits that AI brings to your business/project? What are the main challenges you faced in implementing AI to address your problem?
Responsible AI: Focus on Ethics, Governance, and Sustainability	Collecting insights on how the initiatives see responsible AI in their projects, and how it relates to the SDGs and ethics. Addressing framings for urban AI.	Which SDGs does your organization/project address? How does your work relate to urban AI? How does your work resonate with responsible AI?

The interviews were conducted online, recorded, and lasted between 30 and 45 minutes.Participants were purposively selected from professional networks and industry databases to capture cases relevant to the research questions. This approach is well-established in qualitative research, emphasizing depth and contextual insight over statistical representativeness (Palinkas et al., 2015). While transferability may be limited, Table 2 presents selection criteria and contextual details that support their relevance in similar settings. The analysis of the interview transcripts combined deductive coding, guided by the literature, with inductive coding, and both processes led to the categories structuring Section 4.

3.1. Selected Urban AI Initiatives Operating in 19 African Countries

The interviewees are involved in various AI initiatives operating in at least 19 countries across Africa. The initiatives were established between 2016 and 2022. Six are university-based across seven African countries, and five are companies operating in over 10 countries. All universities and one company emphasize human capital development, training the next generation of African AI professionals, while also running applied projects addressing societal challenges. Most initiatives aim for application across their regions. Thirteen integrate tool development with broader implementation involving stakeholder engagement and environmental understanding, while two focus solely on tools. Tools deliver technical solutions, whereas services incorporate context-specific, stakeholder-driven elements. Participants from academia and industry view AI, economic prosperity, and sustainable development as closely linked, reflecting a shared commitment to leveraging AI for innovation, inclusivity, and sustainability across sectors and regions (Table 2).

Table 2. Interviewees representing AI initiatives operating in Africa.

Participant	Gender	Organization Type/Scope of Work	Role	Countries	Mission and Beneficiaries
1	M	Company AI field (AI tool)	Founder & CEO	Egypt	Democratizing AI computer vision. Offering the means for everyone to create a customized machine learning (ML) model. Beneficiaries: Industry, system integrators, robotics providers or integrators.

Table 2. (Cont.) Interviewees representing AI initiatives operating in Africa.

Participant	Gender	Organization Type/Scope of Work	Role	Countries	Mission and Beneficiaries
2	M	Startup Design office (AI service/AI tool)	Consultant	Tunisia	Provide solutions for individuals and urban environments. Beneficiaries: Public and private organizations.
3	F	Company Training academy (AI service)	Project manager	Egypt	Incubator for transformative human capital, and empowerment and engagement of key societal groups. Beneficiaries: Youths, women, governmental officials.
4	M	University Applied research project (AI tool)	Professor	Zimbabwe, Botswana	Enable sustainable, reliable, and affordable energy access. Improve the quality of life for underserved populations. Beneficiaries: Low and middle-income households in sub-Saharan Africa.
5	F	Company Mapping agency (AI service/AI tool)	Media manager	Zambia	Adaptable AI-based foundational mapping for global development. Tailored mapping solutions for community development. Beneficiaries: Local governments, vulnerable residents.
6	M	Company IT services (AI service/AI tool)	CEO	Tunisia	Social entrepreneurship and innovation. Drive positive social change through support for small and medium enterprises (SMEs). Beneficiaries: SMEs.
7	M	Startup AI and food security (AI Tool)	Founder & CEO	Kenya	Strengthen food supply chains using ML and address food security concerns. Beneficiaries: Local community in Kiambu.
8	M	Company AI field (AI service/AI tool)	Founder & CEO	Nigeria	Standardization and digitization of indigenous languages. Enable participation in the global technology ecosystem. Beneficiaries: Government, education agencies.
9	F	Company Data innovation (AI service/AI tool)	Solutions ambassador	South Africa	Promote global AI initiatives with youth involvement. Create job opportunities for African youth in AI. Beneficiaries: AI companies, African youth.

Table 2. (Cont.) Interviewees representing AI initiatives operating in Africa.

Participant	Gender	Organization Type/Scope of Work	Role	Countries	Mission and Beneficiaries
10	M	Startup (AI service/AI tool)	Managing director	Connects initiatives from multiple African countries	Create an Africa–Europe startup and innovation ecosystem. Enhance technology capacity and collaboration. Beneficiaries: Tech hubs, young developers, entrepreneurs. Includes initiatives from Senegal, Congo, Burkina Faso, Kenya, Tanzania, Uganda, Rwanda, South Africa, Zambia, Nigeria, Algeria, Morocco, Tunisia, Egypt.
11	F	University Research and training (AI service/AI tool)	Professor	Cape Verde	Excellence center for innovative research using emerging technologies to address societal challenges. Beneficiaries: Local communities, academic community.
12	M	University Research and training (AI service/AI tool)	Senior lecturer	Ghana	Develop talent and skills that will champion the digital transitions in this African sub-region, focusing on knowledge areas related to AI. Beneficiaries: Public authorities, communities, students.
13	F	University Research and training (AI service/AI tool)	Lecturer	Namibia	Excellence hub in education, training, research, and innovation. Train students to be able to develop AI systems for Africa by Africans. Beneficiaries: Students, academic community.
14	M	University Research and training (AI service/AI tool)	Lecturer	Mozambique	Promote the use of AI in the agriculture sector in Mozambique. Beneficiaries: Local communities, students.

4. Results and Discussion

4.1. Relevance of AI Initiatives: Domains, Tools, Services, and Beneficiaries

4.1.1. Training and Education

Education was cited by multiple initiatives as a core domain. Five initiatives focus on training new AI talent, while two view AI more as a means to educate specific communities on targeted topics. For universities, training students in AI is achieved through developing tools and applications that address pressing local issues with a strong technical focus (initiatives 11, 12, 14). This is reflected in the identified beneficiaries:

public authorities, local communities, and the academic community. Initiative 3 offers training for executives and managers across sectors, aiming to build capabilities and skills to improve productivity and efficiency. Initiative 4 is an applied research project prioritizing community beneficiaries, while initiative 13 emphasizes education and training, with student-developed projects mostly remaining prototypes tested at the academic level, with limited potential for broader implementation.

4.1.2. Agriculture and Food Security

Four initiatives are developing AI-based tools or services for agriculture-related activities and improving food security. In our sample, agriculture and food security appear closely linked, placing these solutions under the urban AI umbrella. Initiative 7 plans to leverage a large dataset in Kenya to strengthen the agricultural supply chain using machine learning (ML), addressing food security concerns. Initiative 11 has two ongoing projects with local farmers focused on early pest detection and improved automated irrigation. Both initiatives use AI techniques such as ML and computer vision while preserving farmers' agency by keeping them in charge of decisions, supported by app-generated inputs and recommendations.

Initiative 12 shared two projects: one on early pest and disease detection using ML, and another on identifying adulterated food already on the market, targeting common local vegetables and fruits. Initiative 14 focuses on detecting diseases in banana and tomato plants using images of crop leaves to train an algorithm. The model runs on mobile devices, allowing farmers to identify diseases in the field by photographing affected leaves.

4.1.3. Health

Employing AI to support health-related issues was a field identified by three initiatives, all of which are based at universities. Initiative 11 has launched a project where AI is used to provide guidance through a public health kiosk. The envisioned chatbot tool is designed to communicate with everyone passing by and in need of counseling by collecting their questions and promptly responding or escalating them to the human in the loop. Communication is intended to be established using a synthetic voice system and natural language processing (NLP) trained to be accessible in various native languages. Initiative 12 employs ML to predict and detect rare diseases in infant children. Initiative 13 described a student assignment in which a chatbot for positive mental health was developed, integrating and addressing the specific concerns relevant to the university's student community.

4.1.4. Mapping, Planning, and Resource Management

Three initiatives offer AI-based services for mapping, planning, and resource management. Initiative 2 uses AI to process and visualize urban big data, integrating real-time data to identify and map issues and plan responses to urban challenges. Initiative 5 employs AI to generate base maps for analyzing and monitoring socio-economic growth to support decision-making. Based on aerial imagery and AI-ML techniques, the system can identify, label, and vectorize features such as roofed structures, natural surfaces, sealed surfaces, roads and road networks, grass, trees, and water. These tools are especially useful for accelerating the mapping of rapid urbanization and informal settlement sprawl, aiding urban planning and management. Initiative 4 focuses on solar storage systems that provide reliable, affordable household energy access and support weak or stressed electricity grids in Zimbabwe and Botswana. Beneficiaries range from policy actors and governments to local communities.

4.1.5. Consulting and Support for Private Industry Actors

Five initiatives support other stakeholders in improving business models and organizational processes using AI. Initiative 1 focuses on developing and offering AI- and computer vision-based tools that enable users to build their own AI models by uploading images, labeling them, and providing contextual data for training. The service supports edge or cloud deployment and requires no technical background or coding skills, making AI accessible for individual goals. Initiative 6 matches companies' needs with market tools, offering consulting services from web development to AI, data science, and IoT. Initiative 9 developed an application for accurate audio-to-text conversion, offering fast turnaround, customization, and secure data handling. AI is used for entity classification to efficiently sort customer data, eliminating manual processing. The service also includes training customized ML models with project-specific labels, enabling seamless integration into existing workflows and supporting AI-powered decision-making.

Two initiatives take a different approach, focusing on training and creating an enabling environment through experience exchange and preparedness. Initiative 3 offers consultancy across areas such as strategic planning, organizational restructuring, training, content development, and IT. It also uses AI to build predictive market development scenarios. Initiative 10 aims to create an Africa–Europe startup and innovation ecosystem for collaboration and exchange, targeting tech hubs, young developers, and entrepreneurs.

4.1.6. African Native Languages and Inclusion

Several initiatives noted that access for many local communities goes beyond simply using a smartphone or having internet connectivity. Local languages are widely used by the identified beneficiaries. Therefore, language-support modules must be integrated into solutions, or they will not effectively serve these communities. Initiatives 11 and 12 addressed this issue in relation to applications developed for local farmers, emphasizing that some native languages are only spoken, meaning these communities are neither able nor interested in using tools that rely on typing or reading.

Initiative 8 proposes using AI to promote the standardization and digitization of indigenous languages and to localize digital platforms, aiming to empower 1 billion Africans to participate in the global technology ecosystem. In doing so, they see themselves as both protecting indigenous African languages and simplifying communication through digitization. Initiative 9 offers a tool to improve business models and support organizational aspects; however, the importance of incorporating African voices and languages into their tools is clearly stated.

4.2. Redefining the Concept of Urban AI for the African Context

The findings suggest that urban AI in African contexts cannot be understood as a purely technological layer added to existing systems. Instead, it emerges as a socio-technical practice shaped by context-specific constraints, local knowledge, and participatory dynamics.

The motivations behind the analyzed initiatives to employ AI are diverse. However, all recognize AI's potential to expedite data processing and support decision-making. Some initiatives (4, 5, 7) consider AI the easiest and most effective solution, while others (1–3, 6, 8–14) emphasize its transformative potential for Africa. As seen

in Section 4.1, urban AI in Africa does not align neatly with sectoral boundaries or urban–rural divides. Instead, there is an interrelatedness of challenges around capacity, resources, and infrastructure that AI offers hope to address (Eke et al., 2023). For these initiatives, it is not about simply adding AI to a digital strategy, but about developing solutions to specific problems within constrained infrastructure and resources. While these problems may manifest in urban settings, they are not disconnected from issues typically associated with suburban or rural areas. Similarly, the solutions can often be adapted to non-urban contexts.

The case of agriculture and food security is illustrative. In Cape Verde (initiative 11), farms are considered part of cities on Santiago Island. In Ghana (initiative 12), large farms exist in both urban and rural areas, facing similar challenges. Conversely, food insecurity can disproportionately affect urban communities, especially those in informal settlements that often lack basic services, despite the broader infrastructure of cities, making adaptation based on existing infrastructure essential (Butcher et al., 2021).

Universities and businesses are integral to the urban AI ecosystem due to their strategic urban positioning. However, the scope of their work and their vision for scalability do not align with addressing only abstract urban problems. Instead, their focus lies in tackling concrete, cross-cutting issues, often in collaboration with affected communities (Sinde et al., 2023; see also Wakunuma et al., 2022).

Universities are also connecting cities and countries in Africa around AI and its use. Initiative 4 connects Zimbabwe and Botswana; initiative 11 works with Ghana, Senegal, and Mozambique; initiative 12 with Rwanda, Cape Verde, and Senegal. Initiative 14 unites stakeholders across Africa. Synergies also emerge beyond academia. Initiative 10 supports networking among African entrepreneurs and startups.

The impacts of AI tools and services on urban communities span inclusion, social cohesion, sustainability, and economic prosperity. Initiative 1 highlighted the value of democratizing AI and computer vision for widespread industrial use, unlocking new opportunities for businesses. Initiative 4 aims to improve access to basic infrastructure in underserved communities through AI. Initiatives 7, 11, 12, and 14 have developed tools to address food (in)security. Initiative 8 shows how AI can help preserve indigenous African languages by supporting native speakers in communication. Initiative 12 noted that using AI and predictive analytics in farming for early detection of pests and diseases has proven advantageous for insurance, increasing smallholder farmers' access to credit and enabling business growth.

4.3. AI and Sustainable Development

Sustainable development emerged as a key theme in discussions of responsible AI and was acknowledged by all initiatives in this study. To deliver responsible-AI-based tools and services, developers consider how these contribute to the common good. The literature notes that the SDGs can serve as a framework closely aligned with the core tenets of Ubuntu (Ewuoso & Hall, 2019), promoting decisions that enhance communal relationships and strengthen collective capacity. While this approach may be complementary, it does not overlap with utilitarian, individualistic, or deontological models often embedded in AI ethics frameworks external to the African context (Dignum, 2023). In this sense, the SDGs have become more than indicators; they enable both goal and value alignment to foster the common good and societal well-being.

Many initiatives focus on SDG 9 (Figure 2), reflecting a vision to use AI for industrial and infrastructural development within African nations. However, economic growth and technological advancement should not be viewed as the sole drivers of strategic alignment with the SDGs. SDGs 4 and 8 were mentioned by nine and seven initiatives, respectively, underscoring how AI is often considered when prioritizing skills development and capacity building. SDGs 2, 5, 11, and 17 were each cited by six initiatives, becoming more specific to the fields in which they operate.

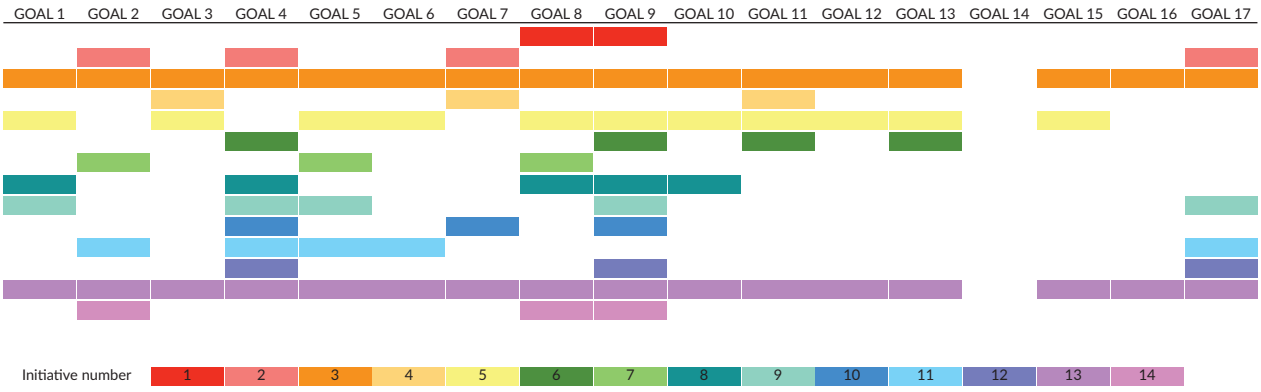

Figure 2. SDGs targeted by each initiative participating in this study.

While AI can support technical solutions and foster innovation in African cities, it often falls short of addressing the root causes of urban challenges, such as poverty, inadequate infrastructure, and limited access to essential services. Without tackling these foundational issues, AI risks producing only short-term gains, raising questions about its alignment with broader goals (Vinuesa et al., 2020). Assessing the impacts of AI requires a sustainability lens that considers both its contribution to the SDGs and the sustainability of AI itself, including financial, strategic, and ethical trade-offs, opportunity costs, capacity constraints, and potential long-term social and environmental impacts (Frimpong, 2025; van Wynsberghe, 2021).

4.4. Responsible AI: A Socio-Technical Approach

Several initiatives position their work in relation to the common good and address implementation challenges, but also consider how to embed ethical principles directly into their AI solutions. The most frequently cited approach for ensuring inclusion and value alignment is participation. Initiatives 11 and 14 actively involve users and intended beneficiaries throughout the development process. Participation and inclusion also share the common objective of lowering barriers to access and empowering individuals and communities (Fontes et al., 2024). For example, initiatives 1 and 8 prioritize accessibility, offering AI tools that require neither coding knowledge nor fluency in dominant languages. Similarly, initiatives 9, 11, and 12 identify language accessibility as a key barrier and have taken steps to ensure their solutions accommodate native and often oral-only languages, making them more accessible to the communities they serve. To prevent potential harms, initiatives 11, 12, and 13 have proactively worked to reduce algorithmic bias and minimize the risk of offensive or harmful speech in chatbot interactions. Initiative 12 mentioned the development and testing of an ethical framework aimed at ensuring AI tools are delivered with integrity and equity, while respecting individuals. The framework encourages researchers and students to remain aware of AI's social impacts.

In many African cities, access to digital tools, education, and connectivity remains highly uneven, creating barriers for marginalized populations (Malatji, 2026). AI systems that assume digital literacy, constant connectivity, or standardized language proficiency risk benefiting only select groups, exacerbating social and territorial inequalities. Limited institutional capacity, funding, and political stability further constrain the implementation of responsible AI, highlighting the need for governance frameworks tailored to local realities rather than imported models (Isagah & Ben Dhaou, 2024). Responsible AI requires a context-sensitive approach rather than universal frameworks, so that Africa's diverse socio-cultural values, which emphasize communality over individualistic norms, are reflected (Yilma, 2025).

4.5. Data and Implementation Challenges

Data was mentioned by most of the initiatives as a major challenge in developing their work and tools. Some initiatives (3, 4, 10, 11, 12, 14) specifically cited the lack of both quantity and quality data, particularly data originating from Africa. Others (5, 6, 7, 9) highlighted difficulties in curating, handling, and managing data. This suggests that the continent is grappling not only with limited data but also with a lack of expertise and resources to effectively manage data. To address these challenges, initiatives 11 and 12 emphasized the importance of collaborating with other universities working on similar projects to build large datasets and reduce the overall costs associated with data collection.

Costs and funding are also recurring challenges. For instance, several universities expressed concern about the sustainability of their projects once initial funding ends. Common questions include how communities can continue to benefit from tools and support provided by researchers, and how projects can be scaled to reach more beneficiaries. Initiative 12 shared their intention to spin off research projects into startups or transition them to be managed by an NGO in collaboration with the university. Initiatives 12 and 13 noted the difficulty of conveying to students the importance of ethics in AI. The absence of a supportive environment and fragile governance structures were also cited as major barriers, limiting the expansion and scalability of initiatives (initiatives 1, 2, 5, 7, 9). In Africa, many initiatives depend on external donors and international partnerships, which can limit local ownership and reduce long-term sustainability (Malatji, 2026). Once external funding ends, many projects struggle to continue, raising questions about the lasting impact of such interventions. AI initiatives must be aligned with the needs, values, and capacities of the communities they aim to serve. Active engagement of communities and participation from the beginning is key to embedding trust, ownership, and relevance.

Another key challenge relates to infrastructure limitations, whether in computational power or other essential systems required to implement AI tools and services (initiatives 1, 4, 6, 8, 10, 11, 12, 13). Additionally, some initiatives noted that a general lack of awareness has slowed AI adoption. This challenge spans stakeholders from government authorities to communities and often leads to insufficient support, hindering effective implementation and outcomes (initiatives 1, 2, 11, 12, 13, 14). Therefore, improving AI awareness and literacy in Africa is crucial (Haruna et al., 2025).

Overall, the growing involvement of the private sector in AI in African cities offers needed resources but also risks reinforcing inequities if commercial motives overshadow local needs. Persistent challenges, such as scarce high-quality, locally relevant data, limited computational infrastructure, and uneven access to AI skills, weak governance, and underdeveloped policy, exacerbate the potential for techno-solutionism, where

profit-driven solutions may displace locally grounded alternatives (Aryee et al., 2025; Plantinga et al., 2024). Strengthening AI literacy, ethical awareness, and multi-stakeholder collaboration is therefore essential to empower communities to critically engage with private-sector initiatives and ensure AI serves the public rather than being mainly driven by commercial interests (Malatji, 2026).

The analysis reveals that urban AI becomes effective and ethical only when operationalized through context-sensitive, participatory practices aligned with responsible AI. These findings reinforce calls for moving beyond purely technocentric models of urban innovation toward hybrid approaches (Hendawy & da Silva, 2023).

5. Responsible Urban AI in African Contexts: Critical Reflections and Recommendations

The findings highlight how responsible urban AI in the African context reflects collective forms of sensemaking, collaboration, and distributed expertise that are already present within African AI initiatives. These elements resonate with the CUI framework, which calls for co-governance models. In this section, we propose a co-governance model grounded in a CUI framework and informed by findings from our exploration of urban AI initiatives in Africa.

5.1. CUI as a Framework

Across the analyzed initiatives, a consistent pattern emerges: Urban AI becomes effective and ethically grounded when operationalized through context-sensitive, participatory practices aligned with responsible AI. These practices collectively resemble what can be conceptualized as CUI, where human, institutional, and algorithmic agents co-produce locally relevant urban knowledge.

CUI refers to the capacity of urban systems to harness shared knowledge, data, and collaborative decision-making to address complex and interdependent urban challenges. Unlike smart city paradigms, which often emphasize technology and data-driven efficiency and prioritize top-down interventions (Batty et al., 2012), CUI emphasizes the integration of human, social, institutional, and ecological intelligence in shaping urban outcomes (Ravetz, 2018).

5.1.1. Context-Sensitive

CUI requires an understanding of local social, cultural, and environmental contexts. Interventions should be developed to embed specific conditions and needs of communities rather than applied as standardized technological fixes. Context-sensitive approaches recognize that knowledge is embedded in local practices, networks, and experiences, and that meaningful interventions must engage with these dynamics (Evans et al., 2016; Ravetz, 2018).

5.1.2. Alignment With the Common Good

The driving goals should orient toward societal benefit rather than narrow efficiency or profit. This involves actively addressing questions of equity, inclusivity, and sustainability in urban planning and policy. The alignment with the common good requires balancing competing priorities, such as economic growth and

environmental protection, and ensuring that marginalized communities are empowered to participate in knowledge creation and decision-making processes (Ravetz, 2018).

5.1.3. Responsible in Practice

Ethical considerations, including privacy, transparency, accountability, and democratic governance, must underpin the deployment of AI in urban settings. Responsible practice involves not only safeguarding citizen data but also ensuring that participatory processes are meaningful, and that decision-making remains accountable to local communities. This principle extends beyond compliance to a proactive ethos of civic stewardship, where urban intelligence is used to enhance rather than undermine social cohesion (Ravetz, 2018).

5.1.4. Identifying Challenges, Navigating Uncertainties, and Overcoming Structural Vulnerabilities

Institutional silos, fragmented knowledge systems, and uneven technological capacities can hinder collaboration and effective knowledge sharing. Disparities in access to digital infrastructure or civic participation may further exacerbate social inequities, creating barriers to fully realizing the benefits of collective intelligence. Cities also operate under conditions of deep uncertainty, including environmental, social, and economic shocks. Adaptive governance strategies should therefore incorporate scenario planning, participatory foresight, and continuous feedback loops to anticipate unforeseen challenges and enhance resilience. Structural vulnerabilities, such as socio-spatial inequalities, constrained resources, and environmental risks, pose persistent threats to urban resilience. Identifying these vulnerabilities and implementing strategies to mitigate them is critical for maintaining equitable and sustainable development trajectories (Ravetz, 2018).

5.2. Responsible Urban AI as the Ethical and Procedural Foundation of CUI: Toward a Co-Governance Model

Implementing urban AI in African cities requires ethical and context-sensitive frameworks that align technology with societal well-being. CUI emphasizes cities as interconnected socio-technical systems, where AI supports collaborative problem-solving and adaptive governance. A co-governance approach engages communities, universities, startups, and governments in shaping solutions. Table 3 highlights the four pillars of the proposed framework: context-sensitive urban AI, alignment with the common good, operationalizing responsible AI from a socio-technical and institutional perspective, and navigating data and implementation challenges, illustrating how African initiatives operationalize ethical, inclusive, and locally adapted AI practices to advance sustainable urban development.

Table 3. Operationalizing responsible urban AI: pillars, recommendations, and examples.

Pillar	Key Recommendations	Examples From Featured Initiatives
Context-sensitive urban AI	Critically assess AI's applicability and relevance to specific problems. Adapt solutions to existing infrastructure to reduce costs and increase scalability. Tailor frameworks to local governance capacities and socio-political realities. Prioritize context-specific approaches over one-size-fits-all solutions. Develop adaptive, self-sustaining solutions. Foster cross-country collaborations to co-develop strategies.	All initatives refer to context-sensitive AI by addressing problems in resource-constrained settings. Initiative 11 integrates AI for urban farms; initiative 12 adapts AI for urban and rural farms; initiative 4 improves basic infrastructure access. Cross-country collaborations (4, 11, 12, 14) demonstrate co-development strategies aligned with local realities.
Alignment with the common good	Engage local communities from the outset. Build collective ownership across civil society, universities, start-ups, and local governments. Ensure AI tools do not reinforce territorial or socio-economic exclusion. Integrate African values (e.g., Ubuntu) into AI design and governance. Base ethical and social impact assessments on local value systems.	Initiatives 1, 4, 7, 8, 11–14 operationalize alignment with the common good. Initiative 1 democratizes AI for industry; initiative 4 improves infrastructure; initiatives 7, 11, 12, 14 tackle food insecurity; initiative 8 preserves indigenous languages; initiatives 11, 14 use participatory co-design to lower access barriers; initiatives 11–13 implement ethical frameworks to reduce algorithmic bias and ensure equity, aligning AI with societal well-being.
Operationalizing responsible AI from a socio-technical and institutional perspective	Build or strengthen local AI governance structures. Promote AI literacy across all societal segments. Ensure inclusivity and accessibility (language, digital literacy, infrastructure). Co-develop ethical frameworks with local stakeholders. Integrate ethics education into formal and informal training. Ensure transparency and accountability from private actors. Make communities aware of opportunities and risks of private-sector AI.	Initiatives 1, 2, 11–14 demonstrate responsible AI through ethical design, governance engagement, and capacity building. Initiatives 11, 12 collaborate to create shared datasets and reduce costs; initiatives 12, 13 integrate AI ethics education; initiatives 1, 2, 14 raise awareness among governments, civil society, and communities. Efforts to manage private-sector influence ensure transparency and alignment with public interest.
Navigating data and implementation challenges	Develop adaptive, self-sustaining solutions rather than one-off pilots. Adapt solutions to existing infrastructure to minimize costs. Prioritize context-specific approaches over generic models.	Initiatives 3–7, 9–12, 14 tackle data scarcity, curation, and management issues. Infrastructure limitations are addressed by initiatives 1, 4, 6–8, 10–13. Initiative 12 ensures sustainability by transitioning projects to NGOs or startups. Partnerships, knowledge sharing, and adaptive design help overcome resource limitations and scalability challenges.

6. Conclusion

While AI holds promise for addressing urban challenges, from infrastructure gaps to service delivery inefficiencies, its transformative potential in Africa remains limited unless embedded within supportive, inclusive, and contextually relevant frameworks. African-led AI initiatives are emerging with the goal of serving local communities and contributing to the common good, yet their ability to scale and sustain impact is often constrained by limited governance infrastructures, dependence on external funding, and the absence of context-sensitive ethical frameworks. To harness AI's benefits while mitigating risks, urban AI in Africa must be developed with communities, for communities, and by stakeholders who understand local values and realities. This requires reimagining responsible AI not as a universal blueprint imported from elsewhere, but as a locally rooted practice that draws on African philosophies such as Ubuntu, prioritizes collective well-being, and centers marginalized voices. As African cities continue to adopt AI-driven tools, embedding these within a collective intelligence framework may transform not only how urban technologies operate but also how cities themselves learn, reason, and evolve.

This article contributes to the understanding of urban AI in Africa by highlighting how context-sensitive, inclusive, and ethically grounded approaches can transform AI from a technological intervention into a tool for sustainable and equitable urban development. By analyzing 14 African initiatives, the study demonstrates how AI solutions can be tailored to resource-constrained environments, addressing local problems while leveraging existing infrastructure and governance capacities. The findings and recommendations emphasize the importance of aligning AI with the common good, showing how initiatives integrate African values such as Ubuntu, promote collective ownership, and ensure inclusivity across language, digital literacy, and socio-economic divides. Furthermore, the operationalization of responsible AI through participatory design, capacity building, and ethical governance highlights strategies to mitigate risks associated with private-sector influence, data scarcity, and implementation constraints.

Several limitations of this study should be acknowledged. The analysis focuses on 14 initiatives, which, while diverse, may not fully capture the broader spectrum of urban AI interventions across the African continent, potentially limiting the generalizability of the findings. The data rely primarily on self-reported information from the initiatives, which may introduce reporting bias regarding achievements, challenges, and impacts. Although cross-country collaborations are highlighted, there is limited longitudinal evidence to assess the sustainability, scalability, and long-term societal effects of the AI solutions. The substantial contextual heterogeneity across African cities, including variations in governance structures, infrastructure, socio-economic conditions, and cultural practices, is not comprehensively captured, limiting the universal applicability of the findings and underscoring the need for additional localized empirical research to validate and extend these insights.

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Conflict of Interests

In this article, editorial decisions were undertaken by Sónia Semedo (University of Cabo Verde).

Data Availability

Data are available upon request.

LLMs Disclosure

ChatGPT and Google Gemini were used to support language refinement, structural editing, and clarity checks during manuscript preparation and revision. These tools were used to edit language in the interview manuscript; they improved sentence structure and clarity; the interviewer, interviewee, and analyst are non-native English speakers. The authors reviewed and verified all AI-assisted edits and retain full responsibility for the conceptual framing, analysis, interpretation, and final scholarly decisions.

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