Unveiling AI Concerns for Sub-Saharan Africa and its Vulnerable Groups

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Abstract

In Sub-Saharan Africa (SSA), artificial intelligence is still in its early stages of adoption. To ensure that the already existing class imbalance in SSA communities does not hinder the realization of the Sustainable Development Goals, such as data security, safety, and equitable access to AI technologies, acceptable reliability measures must be put in place (as policies). This paper identifies some of the vulnerabilities in AI and adds a voice to the risks and ethical concerns surrounding the use of AI and its impact on SSA and its vulnerable groups. Our systematic literature review of related research between January 2014 and June 2024 shows the current state of AI adoption in SSA and the socio-political challenges that impact its development, revealing key concerns in data Governance, safety privacy, educational and skill gaps, socio-economic impacts, and stakeholder influence on AI adoption in SSA. We propose a framework for designing data governance policies for the inclusive use of AI in SSA.

Keywords: Artificial intelligence, equitable access, data governance, vulnerable groups, responsible AI, Sub-Saharan Africa

1. Introduction

Africa preserves some of the world's oldest cultures and traditions. However, traces of colonialism still affect its sociopolitical affairs, posing challenges to its significant contribution to achieving Sustainable Development Goals (SDGs) and the widespread adoption of AI (Register, 2021; Ricardo et al., 2020; Wen and Holweg, 2023). Despite AI's tremendous potential to help achieve global Sustainable Development Goals (SDGs) such as poverty alleviation, equitable education, improved health, clean and affordable energy, and strong institutions, most African countries, particularly those in SSA, rank lowest on the government readiness scale for AI adoption. This is despite the clear need for AI interventions to address pressing socioeconomic issues (Ricardo et al., 2020).

The emergence of AI has significantly improved most technologies and processes. Professional services giants PwC and McKinsey claim AI could add nearly $16 trillion and $13 trillion respectively to the world economy by 2030 (Ricard, 2020). Despite the value of AI in developed countries, its potential in SSA remains uncertain. The region's uneven and slow technological development highlights the need for intervention, with AI offering major solutions in diverse sectors (Gwagwa et al., 2021). While the region suffers holistically, its vulnerable groups[1] suffer even more (Kong et al., 2023). The issues of privacy, accountability, transparency, privacy protection, data protection, protection of human and intellectual rights, and the long-term sustainability of these magical technologies remain major concerns for AI acceptance and adoption on different levels (Register, 2021; Wen and Holweg, 2023).

The current situation in Africa appears critical compared to the Global North. This reflects Africa's limitations, including a lack of training, high-quality datasets, sociopolitical factors, and infrastructure required for developing and adopting AI technologies unique to Africa. Many African nations lack the infrastructure, data, and elements necessary for widespread technology adoption. Concerns about interpretability, accountability, and inclusivity remain for the wholesale adoption of AI technologies (Kong et al., 2023). These are apparent in recent cases e.g. harmful AI uses have been observed in Libya with autonomous weapon systems and in Zimbabwe with facial recognition surveillance (Davis et al., 2022), the

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[1]Vulnerable groups in this work are "undersampled majority" of a group of people who are unlikely to succeed because the environment is hostile towards them and any community that has been marginalized in the tech industry (Buolamwini and Timnit, 2018).

discovery in 2018 that Amazon's AI-based resume selection tool was biased against women (Hamilton, 2018), the accidental crushing of a seven-year-old boy's finger by an intelligent chess-playing robot during a chess game in Moscow (Jones, 2022), and et cetra.

Notwithstanding the alleged efficiencies of the AI technologies in these cases, the unfortunate discovery boils down to: *any model could only be as good as the data we use to train it*. It is therefore beneficial for society and businesses to demand interpretable, trustworthy, and reliable AI-based technologies. Our study highlights the need for equitable access to AI technologies and robust data governance policies for SSA. Specifically, we make the following contributions:

- We identify vulnerabilities in AI use and add a voice to the risks and ethical concerns surrounding the use of AI and its impact on SSA and its vulnerable groups.

- We report the current state of AI adoption in SSA and the socio-political challenges that impact its development, harnessing findings from a systematic literature review of related research between January 2014 and June 2024. We also provide the implications of our findings for policymakers, stakeholders, and international organizations working to promote AI adoption in SSA and propose a framework for designing data governance policies for the inclusive use of AI.

- We propose a framework for designing data governance policies for the inclusive use of AI. We report the approach to identifying vulnerabilities in AI adoption which includes a comprehensive evaluation of various factors including policy frameworks, ethical considerations, infrastructure and data ecosystems, socio-economic factors, stakeholder engagement, etc.

2. Motivation

Recent advancements in AI reveal not just its robustness for image processing, fraud detection, malware detection, etc. with mouth-watering results (Akpudo et al., 2023). However, many stakeholders have expressed strong safety concerns. A recent survey shows that over six out of ten respondents (68%) believe AI safety should be prioritized more than it is at present, especially in the military and health sectors (Zhang B. Anderljung M. Kahn L. Dreksler and Horowitz M. Dafoe, 2022). While AI may be useful in the right hands, in the wrong hands, it also poses significant threats to the public (particularly vulnerable groups). In his resignation from Google, the man often credited as the godfather of AI cited concerns about misinformation, the potential for AI to upend the job market, and the "existential risk" of AI (Taylor and Hern, 2023). More recently, Boris Eldagsen, the winner of the prestigious Sony World Photography Awards rejected the award after he admitted to submitting an AI image to the competition and won (O'Kane, 2023). He aimed to provoke a debate about the ethical implications and the need for new categories for AI-generated art in photography competitions. The prestigious Computer Vision and Pattern Recognition (CVPR) conference in 2022 presented new challenges to AI researchers on the need for the authors to discuss both the limitations of their papers and the potential social limits they may cause (Kaye, 2022). While many developers expressed their concerns against providing ethical implications of their work, the organizers and top recruiters at the event like Amazon, Google, Microsoft and Tesla emphasized the importance of ethical considerations guiding how their products are built (Kaye, 2022). The recent concerns from minority group activists highlight the potential risks of racially biased, gender-biased, and sexually biased predictions made by AI-assisted investigations and recommendation systems in law enforcement agencies. (Luefer, 2023). In Europe, several human rights activists are currently pushing back against legalizing the use of AI that is incompatible with human rights including the adoption (and use) of intelligent gender recognition systems that predict sexual orientation(Forum, 2021; Luefer, 2023). These and many more ethical concerns provide valid standpoints for continued research on responsible AI.

While reliability issues inherent in AI technologies continue to linger in developed regions, SSA's unique (underdeveloped) sociopolitical ecosystems further threaten AI adoption (Ade-Ibijola and Okonkwo, 2023; Ricardo et al., 2020). Notwithstanding these setbacks, commendable efforts towards achieving a more responsible AI are underway. In a collaborative effort, tech giants like Amazon, Facebook, Google, Microsoft and IBM formed the Partnership on Artificial Intelligence (PAI), a central theme for ensuring safe, positive, desirable, and socially acceptable AI-based technologies for industrial/commercial use (de Laat and B, 2021). Meanwhile, several research findings reveal that a hasty adoption of AI across different industries may pose significant ethical threats, particularly because there are not any standardised explainability/interpretability frameworks for fully (and consistently) understanding the black-box nature of machine learning (ML) models which form the backbone of AI technologies. This presents the question: *how trustworthy, reliable, and safe is AI?* Also, with the heightened concerns of privacy, inclusion, and safety, the question of *how inclusive are AI technologies?* and *who should be held accountable if/when these AI technologies go against ethical standards?* are currently raised. On the one hand, SSA's vulnerabilities to a hasty AI adoption demand careful evaluations of trustworthiness, reliability, and equitable access (Effoduh et al., 2023). Adopting existing AI

technologies too soon without key adaptation policies could harm local communities and infringe on their fundamental human rights (Effoduh, 2024). Such a hasty adoption may also fail to tackle problems peculiar to Africa and Africans but was not considered by the original developers (Kong et al., 2023). On the other hand, its vulnerable groups like disadvantaged persons, geographically isolated persons, underserved populations, racialized visible minorities, women, the elderly, Indigenous communities, informal workers, migrants and refugees, among others may also be affected by an AI adoption without inclusive data governance policies in place (Ade-Ibijola and Okonkwo, 2023; Kong et al., 2023).

3. AI and Vulnerable groups

Recent AI is difficult to govern and innovations are implemented before the risks are fully understood (Effoduh, 2024; Kong et al., 2023). SSA's vulnerabilities to a hasty AI adoption demand careful evaluations of trustworthiness, reliability, and equitable access. From a deeper perspective, many vulnerable groups are also found in SSA, which amplifies the importance of discussing AI concerns specifically for this region. This section highlights some of the key AI concerns for SSA and vulnerable groups.

3.1 AI and Vulnerabilities for Sub-Saharan Africa

The approach to identifying vulnerabilities in AI adoption involves a comprehensive evaluation of various factors including policy frameworks, ethical considerations, infrastructure and data ecosystems, socio-economic factors, stakeholder engagement, etc. The question: *how can African governments integrate maintenance policies that guarantee equitable access to unbiased AI technologies?* remains an ongoing puzzle (Effoduh et al., 2023). Although the answer seems far-fetched, it is worth noting that in the quest to adopt these AI technologies, acceptable reliability and accountability measures (backed by policies) must be implemented. This ensures that the already-existing class imbalance in SSA communities does not infringe on the SDGs, especially data security, safety, and equitable access to AI technologies for Africa (Ahmed and Anifowose, 2024). This underscores the importance of trustworthy, safe, and inclusive AI and data governance policies amidst the unfortunate sociopolitical ecosystems in SSA.

The current state of AI in Africa reveals a mixed landscape of potential and challenges. AI technologies are set to significantly impact life and business, with countries like Togo, Zambia, and Kenya already utilizing AI for social funds distribution, election integrity, and advancements in agriculture and education (Ade-Ibijola and Okonkwo, 2023). However, harmful applications, such as autonomous weapons in Libya and facial recognition surveillance in Zimbabwe, highlight the risks (Davis et al., 2022). Despite pockets of adoption in South Africa, Nigeria, and a few other nations, widespread AI implementation is hindered by a lack of infrastructure, data ecosystems, and comprehensive STEM education. To foster sustainable AI growth, collaboration among policymakers, businesses, and research institutions is crucial. Challenges include immature policy frameworks, ethical concerns like data bias and transparency, and an underdeveloped data ecosystem, which often leads to reliance on foreign-trained algorithms (Okolo et al., 2023). Addressing these issues is essential for harnessing AI's full potential while ensuring ethical and equitable outcomes.

It is possible to showcase skills, participate in projects, and gain a deeper understanding of the field as it develops by joining new interdisciplinary ML communities, usually centred on academic institutions and collaborating with industry and development partners (Gwagwa et al., 2021). However, the obvious lack of readiness by the governments in SSA towards actively financing and adopting cognitive AI technologies remains a major challenge. For instance, a UNESCO 2020 survey found that only 21 out of 32 African countries viewed AI development as necessary and prioritized in their national development plans (Unesco, 2020). Arguably, the excuse for such a lack of proper education on AI and acceptance hints at Africa's vulnerabilities which include her colonial past, data colonialism, AI algorithmic imperialism, the trust issues between the Global North and African governments, religious beliefs that infringe AI acceptance in SSA, lack of infrastructure/amenities for enabling AI adoption, data collection, management, and integrity issues, poverty, poor education standards, poor access to information, and AI's magical defiance from the fundamental statistical theory that makes them practically unexplainable to a broader audience (Akpudo and Jang-Wook, 2021).

Notwithstanding Africa's lower patronage of AI, the technology is yet to be fully developed to a level where they no longer black-box in nature. Trustworthiness, explainability/interpretability, and accountability are gradually becoming core requirements in many applications where crucial decisions are made by users relying on a model's outputs (Zhang B. Anderljung M. Kahn L. Dreksler and Horowitz M. Dafoe, 2022). Beyond the earlier examples of major pitfalls associated with black box models (Jones, 2022; Kong et al., 2023), many other instances have been reported against the use of these models and have prompted the movement for algorithmic fairness which stipulates explainability and interpretability of AI models (Liu X. Wang and Interpretable, 2018). In 2018, the European Union (EU) replaced the EU's 1995 Data Protection Directive with new regulations that stipulate that automated processing should be able to provide an explanation to end users

Table 1. Keywords and Search Criteria.

Keywords	Synonyms
Artificial intelligence Trustworthy Africa Vulnerable Groups Data governance	AI, Machine Learning, Smart Explainable, interpretable, Faithful, Responsible, Equitable, Safe, inclusive SSA, Sub-Sahara, Region 8 Underdeveloped, indigenous Data Policy, Strategy, Human rights
Google Prompt	
"Artificial intelligence"|"AI"|"Smart" "Explainable"|"interpretable"|"Trustworthy"|"Responsible"|"Equitable"|"inclusive" "Africa"|"SSA"|"Sub-Sahara"|"Region 8" "Vulnerable"|"Underdeveloped"|"indigenous" "Data Policy"|"Strategy"|"Human rights"	

(Goodman and Flaxman, 2017). Such regulations provide a strong rationale for human decision-makers who rely (fully or to some degree) on AI to accept the professional and legal responsibilities inherent in opting for AI as an assistant for decision-making.

These vulnerabilities are some of the key concerns that need informed deliberation for the governments in SSA to participate in inclusive AI adoption. Data-driven processes are becoming the norm for improved productivity, profitability, and overall success of modern businesses, and reliable AI models are often found at the heart of these processes. Although these technologies are now Western realities and dependency on AI is still in its infancy in Africa, AI communities and activities are emerging across the SSA despite the continent ranking low on global indices and indicators (Ahmed and Anifowose, 2024; Kong et al., 2023). Beyond government participation, African businesses are in the very early stages of integrating AI into their processes. To support future AI initiatives, countries such as South Africa, Egypt, Morocco, Tunisia, Tanzania, Zimbabwe, Cˆote d'Ivoire, Senegal, Zambia, and Botswana have developed data policies, built robust infrastructure, and promoted good data management practices, with South Africa notably ranking among the top 20 globally in AI legislative mentions from 2016 to 2021 (Daniel et al., 2022). While other African countries' participation is currently underway, Data from the Center for Intellectual Property and Information Technology Law (CIPIT) shows that Africa hosts over 2,400 organizations engaged in AI innovation, with 41% of them being startups operating across diverse industries such as health, agriculture, education, law, and insurance (CPIT, 2023). Price Waterhouse Coopers (PwC) estimates that AI could contribute up to $15.7 trillion to the global economy by 2030, with the African economy benefiting from up to $1.5 trillion, 8 or 6% of the continent's Gross Domestic Product. This suggests that the marginal return on investment in AI is high (PWC, 2017).

3.2 AI and Vulnerabilities for Vulnerable Groups

Outside the SSA as a region, the use of AI also raises concerns for many vulnerable groups, which are similarly found within SSA, but in unique ways. Biased algorithms and data play major roles in the pushback from the most vulnerable groups (Ahmed and Anifowose, 2024; Kong et al., 2023; Pigna, 2024). Ideally, AI algorithms are only as unbiased as the data they are trained with. A common concern is a tendency for AI recruitment systems to produce discriminatory outcomes as the study by researchers at Carnegie Mellon University revealed about Amazon (Hamilton, 2018). Another concern is the possibility of misidentification and wrongful targeting by law enforcement against individuals from indigenous communities or migrants. In addition to perpetuating biases and stigmatization against informal workers, AI may lead to exclusion or unfair treatment of those without citizenship rights, migrants and refugees, and people with disabilities.

Lack of transparency and representation of AI algorithms are two other major ethical concerns that further reduce trust in AI. Being black-box in nature, it becomes hard to determine how an ML algorithm reached a particular decision, which can make it difficult to identify and address any bias that may be present. This lack of trust further validates the concerns of underrepresented/marginalized groups and the push for responsible inclusive AI (Ade-Ibijola and Okonkwo, 2023; Luefer, 2023). Also, the moral hazards posed by AI developers can be detrimental to vulnerable groups. AI can devastate vulnerable groups by catalyzing the creation and spread of harmful content such as child pornography, misogyny, misandry, and hate speech (Pigna, 2024). Additionally, rural communities may lack access to reliable internet or have limited technical expertise to develop and implement AI solutions tailored to their needs (Forum, 2020). AI also has the potential to automate many jobs, leading to job displacement and unemployment, particularly for informal workers who may lack the skills or education to transition to new
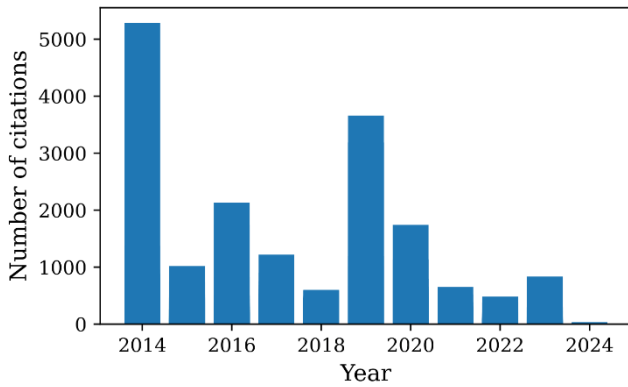
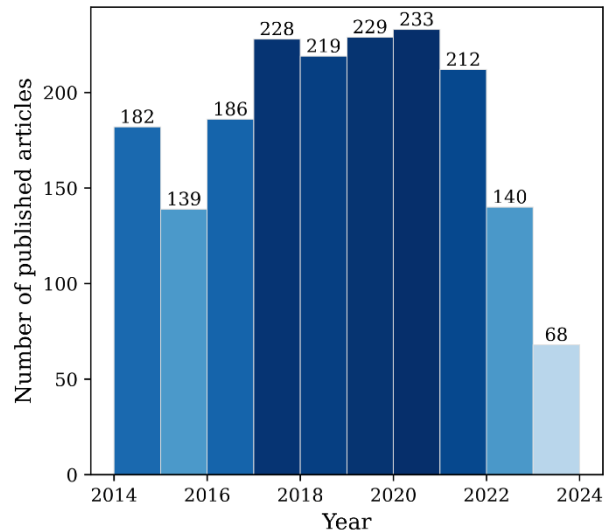Figure 1. Total number of cited articles between 2014 and 2024

Figure 2. Total number of published articles between 2014 and 2024

types of work. The McKinsey Global Institute predicts that 1 in 16 people may be forced to switch occupations by 2030. Job growth is expected to be more concentrated in high-skill jobs, while middle and low-skill jobs may decline by as many as 50 million globally by 2025 due to the adoption of AI in routine-based industries (Forum, 2020, 2023). To guarantee that marginalized groups fully engage in the digital economy, the United Nations Development Programme (UNDP) research emphasizes the need for increased investment in digital infrastructure and skill development (Digital, 2019).

Privacy and security issues rank high on the scale of AI concerns for vulnerable groups. The irresponsible use of AI to collect and analyze personal data could infringe upon people's rights to privacy and freedom of speech. By utilizing intelligent algorithms to match customers and vendors or recognize vulnerable people, the irresponsible use of AI may aid the exploitation of informal workers. It could also reinforce stigmatization and prejudice against them. Among other things, a study by Carnegie Mellon University has found that online informal work platforms use AI to improve their operations, potentially resulting in the exploitation of workers (Tucker, 2018). For vulnerable populations like migrants, refugees, and ex-convicts, the possibility of increased tracking and surveillance is especially concerning. Facial recognition and other biometric technologies used in border control or law enforcement may disproportionately impact these groups, leading to violations of their privacy and human rights, and the EU Agency for Fundamental Rights also confirms this in their reports which reveal that migrants and refugees in the EU are often subjected to intrusive data collection and processing (EU, 2017). It is also possible for AI-powered technologies such as autonomous vehicles and drones to cause harm if they malfunction or are misused. These technologies are dangerous for children, people with disabilities, and women (Díaz Figueroa et al., 2023).

4. A Systematic Review

Overall, there are many concerns related to the irresponsible use of AI and its potential impact on vulnerable groups. It is therefore imperative for developers and policymakers to consider these concerns and take steps to ensure that AI is developed and deployed in fair, inclusive, safe, human-centred, trustworthy, and equitable ways for all. In our attempts to fully understand the nuances surrounding AI and vulnerable groups, and investigate the current (dynamic) atmosphere in SSA, we conducted an extensive systematic literature review, covering almost 2,000 publications from the past ten years on the problems highlighted in this work.

4.1. Systematic Review Methodology

A systematic search was conducted on Google Scholar via Publish or Perish software (Harzing, 2023) using the keywords (and synonyms) detailed in Table 1. The search was limited to articles published between January 1 2014 and June 8 2024. Overall, 1989 articles were sourced, each article containing the number of citations, author names, title of paper, year of publication, article source, publisher's name, article web link, its GS rank, article type (journal, book chapter, conference, etc.), article DOI, ISSN, volume, issue, start and end page, cites per year, cites per author, number of authors, age of article, article abstract, and article URL. Our article selection/rejection criteria are summarized thus: articles were included if they met the following criteria: peer-reviewed, published in English, published between 2014 and 2024, and contains the keywords, their associated synonyms, and the Google prompt in Table 1. Articles were excluded if they were not peer-reviewed, published before 2014, duplicates, or from non-academic sources.

4.2. Analysis and Results

To ensure that the articles included in the systematic review are relevant, high-quality, and impactful, we filtered out articles with citation counts less than ten.

Citation Trends: Out of the 1989 sourced articles, only 1836 (92.3% of sourced articles) were retrieved, revealing that the various nuances surrounding AI and SSA (and its vulnerable groups) have been receiving significant attention in the research community in the past ten years and have been published in over 1098 places. We present in Figure 1 the number of cited articles published over the past 10 years. The results reveal that most of the articles published in 2014 received the highest number of citations followed by a significant drop in the number of citations for articles published between 2015 and 2018. Articles published in 2019 received the second-highest number of citations, followed by yet another significant drop in the number of citations for articles published between 2020 and 2024, 2024 being the least in the ranks.

Publication Trends: We analyzed the number of published articles between the periods and present our findings in Figure 2. The results show that between 2017 and 2022, the number of articles published was the highest with the highest number of articles published in 2020 (a total of 228 articles), revealing the heightened attention to the nuances surrounding AI, SSA and vulnerable groups during the Covid-19 era.

Emerging Themes from Literature: Today, approximately 128 articles covering these nuances have been published, which is a little over 50% of the number of articles published in 2020. This indicates a drop in the level of attention these issues are receiving, amidst the increasing attention on developing more sophisticated ML algorithms such as Generative Pre-trained Transformers (Bengesi et al., 2024).

4.3. Key Findings from Literature

The comprehensive literature review highlights some key vulnerabilities. Addressing them requires a multifaceted strategy involving policy development, infrastructure improvement, education enhancement, ethical guidelines establishment, and robust stakeholder collaboration.

Data Governance: Many SSA countries lack robust data governance frameworks, leading to unregulated data collection, storage, and usage. There is a scarcity of high-quality, representative data crucial for training AI systems. This often results in reliance on foreign datasets that may not accurately reflect local contexts, exacerbating biases and inaccuracies. Also, data ecosystems in SSA are in their nascent stages, primarily driven by the private sector, with limited public sector involvement and support.

Safety Concerns: Instances of harmful AI uses, such as autonomous weapons in Libya and facial recognition surveillance in Zimbabwe, highlight significant safety risks. Inadequate technical infrastructure, including poor internet connectivity and limited computational resources, hampers the safe and effective deployment of AI technologies. Furthermore, the infancy of policy frameworks leaves AI deployment largely unregulated, increasing the risk of misuse and unintended consequences.

Privacy Concerns: The use of AI for surveillance poses serious privacy concerns, with insufficient legal protections for individuals' data and privacy rights. Many AI systems operate with limited transparency, making it difficult to hold developers and users accountable for data misuse or breaches. Moreover, the absence of robust ethical guidelines governing AI use exacerbates privacy risks, as there are few checks on how personal data is collected, processed, and shared.

Educational and Skill Gaps: The lack of strong STEM education programs limits the availability of skilled professionals needed to develop and manage AI systems. There is a significant need for capacity-building initiatives to enhance the skills of local talent in AI and related fields.

Socio-Economic Impacts: The uneven distribution of AI benefits risks increasing socio-economic inequality, as access to AI technologies and their advantages remain limited to certain groups. AI systems trained on biased data can perpetuate and even exacerbate existing social and economic disparities.

Stakeholder Engagement: There is a need for greater collaboration among policymakers, research institutions, businesses, startups, and government agencies to create a supportive ecosystem for AI adoption. Ensuring the sustainability of AI technologies requires a holistic approach that includes input from all relevant stakeholders.

4.4. Implications for Stakeholders working to promote AI adoption in SSA

Policymakers in Sub-Saharan Africa must create comprehensive AI governance frameworks that address data privacy, ethics, and regulation to prevent misuse and ensure safe deployment. Investments in technical infrastructure and STEM education are crucial for supporting AI advancements and developing a skilled workforce. Policies should also promote inclusive growth by addressing socio-economic disparities and biases in AI systems, ensuring equitable benefits for all.

Businesses, startups, and research institutions should collaborate to foster a supportive ecosystem for AI adoption. This includes driving innovation, emphasizing ethical development, and building trust through transparency and accountability. Investing in local talent and prioritizing high-quality, representative local data

Figure 3. Proposed framework for designing data governance policies for the inclusive use of AI

will improve AI relevance and accuracy, making them more effective for local contexts.

International organizations play a pivotal role in supporting the AI adoption journey in Sub-Saharan Africa. They can assist countries in developing and implementing comprehensive AI policies and regulatory frameworks, ensuring that these are robust and effective. They should support Sub-Saharan Africa by aiding in the development of comprehensive AI policies and providing technical resources to bridge infrastructure gaps. Promoting knowledge exchange and advocating for global ethical standards will ensure responsible and sustainable AI adoption, protecting privacy and fostering transparency.

5. Recommendations and Ways Forward

Foreign AI technologies pose high risks to SSA if/when adopted via transfer learning, the reuse of a pre-trained machine learning model on a new problem. Heightened levels of bias, the possibility of new forms of imperialism and colonialism, and data integrity issues are some of the key AI vulnerabilities in SSA. These vulnerabilities further validate the need for explainability, data protection, regulations, privacy statements, and policies, among many others. Meanwhile, the use of AI in Africa has been governed by international and regional data policy frameworks which may be acceptable in some African states and may have inspired policy development on data governance for the use of AI in Africa (Commission, 2021; Unesco, 2021). As a recommendation, existing paradigms for ethical data governance and the use of AI on Africans and its vulnerable groups like the ACHPR/Res. 473 (Commission, 2021) should be supported.

Amidst the pros, governments must prioritize developing data legislation to ensure accountability, transparency, privacy protection, data protection, human and intellectual rights protection, and the long-term sustainability of these technologies. In this light, the

authors propose that the framework presented in Figure 3 for designing data governance policies for the inclusive use of AI for vulnerable groups should cover the following key factors:

Priority Assessment: An assessment of domestic strategic priorities, strengths, and weaknesses is imperative. Policymakers, tech giants and developers must conduct priority assessments before AI adoption/deployment. This assessment should encompass the areas of the country where AI systems will be most responsible and effective. In the absence of adequate digital infrastructure as in SSA, society's needs must first be met by developing safe, inclusive, and affordable technologies. It should also consider the optimum legal framework that covers human rights, data protection rights, legal consequences for violations, remedies, etc.

Governance: African governments and other relevant stakeholders need to think carefully about how to create a data governance policy that promotes an inclusive and responsible AI economy (Ndemo and Thegeya, 2022). This is done by designing data governance policies to support the inclusive use of AI. The expectation is that these policies will contribute to maintaining standards that cover accountability, data protection, explainability/interpretability of machine-learning models, human-centric technologies, and protection of citizens' privacy. Ethics and Standards: The 2021 resolution on human rights, AI, and technology in Africa by the African Commission on Human and Peoples' Rights (ACHPR) emphasizes the importance of adequately respecting African norms, ethics, values, and communitarian ethos (Commission, 2021). This reflects a human-centric metric for assessing AI technologies in Africa. Situating human-centric ethics and standards as yardsticks for assessing AI acceptance ensures that the creation and application of AI comply with standards for human rights, privacy, equality, non-discrimination, inclusion, diversity, safety, fairness, transparency, accountability, and

economic growth in Africa and its vulnerable groups. More so, with evolving human rights and an increasing need for spaces to accommodate vulnerable groups, data policies are expected to align with established human rights standards. This is especially important when remote biometric recognition or real-time facial recognition technologies are used in public spaces. Other risks are covered in the report published by the Office of the United Nations High Commissioner for Human Rights (OHCHR) in September 2021 (Council, 2021).

Legal Concerns: Despite AI's astounding capabilities, data usage and dependence on AI might harm human rights. Modern predictive policing allows law enforcement to forecast future crime offenders, victims, or locations. This has the potential to significantly perpetuate racial and ethnic bias, discrimination, and inequality by leveraging communications data, social media posts, etc. Such technology should not be utilized instead of comprehensive crime reduction strategies and community involvement. AI predictions may result in discrimination, prejudice, and misinterpretation. For example, identifying those more likely to engage in terrorist activity based on historical data, and flagging individuals based on their travel history, race, culture, or religious affiliation. While the benefits abound, these are valid reasons to question its use by law enforcement and should be critically evaluated for trustworthiness.

Value Considerations: Quality control measures should be implemented to ensure data representativeness from different population groups. This is especially important for SSA, where diverse people and communities abound. More so, the use of low-quality, limited, and non-representative data could perpetuate and deepen prejudices causing AI systems to make biased inferences against vulnerable and minority groups. Prioritizing the use of representative data, promoting local AI systems, and ensuring a transparent procurement process for AI systems from outside SSA are highly recommended. Also managing data in a representative, harmonized, interoperable, accessible, accurate, and reusable manner should be encouraged, with the informed consent of data owners. Beyond returning to the drawing board, campaign efforts should be made to sensitize, educate, and inform vulnerable groups via extensive technology upskilling to leverage the opportunities presented by the Industry 4.0 revolution. As fairness and explainability have dominated recent discussions on ethical AI, the five criteria of trustworthiness: competency, reliability, transparency, benevolence, and ethical integrity (Malle, 2022) are yet another paradigm for judging the norm competence of AI technologies. Meanwhile, the authors (Yu et al., 2018) express concern about the need to build ethics into AI by reviewing leading AI conferences such as AAAI, AAMAS, ECAI, and IJCAI. In their taxonomy, they divided the field into four areas: ethical

dilemmas, individual ethics frameworks, collective ethics frameworks, and human-AI ethics. Studies like these help unveil the challenges to implementing norm competence and the critical role that justification, not just explanation, will play in providing evidence for inclusive ethical AI. Although characterized by diversified beliefs, identities cultures, and (sometimes) conflicting political interests, such a dynamic amongst vulnerable groups may be a blessing in disguise for a more inclusive AI adoption in SSA and the Global North. For SSA, success would depend on building strong bilateral agreements between states and transparency in all the AI development processes including procurement, training, testing, evaluation, adoption, and documentation. Overall, it is important to critically evaluate the possible pitfalls of adopting AI technologies and ensure that mitigation policies are integrated. Furthermore, the reliability of AI technologies for SSA and its vulnerable groups should be prioritized before, during, and after adoption as it would help ensure safe ethical, social, and human standards.

6. Conclusion and Future Works

This article unveils some vulnerabilities surrounding the use of AI in SSA and its vulnerable groups and promotes equitable access to new technologies in SSA amidst the anxiety around AI and concerns about data governance. Although recent findings show key participation in AI in legislative proceedings by developed and developing countries, most countries still lack the readiness to implement AI on a widely accepted level, given the risks involved in hasty AI adoption. Notwithstanding these challenges, the recent advances in developing human-centric qualitative and quantitative interpretability/explainability tools for debunking the underlying processes in AI models offer strong hopes for AI acceptance in the near future. This would contribute immensely towards ensuring equitable access to AI technologies, providing legal protection that can properly safeguard users from violations related to the misuse of Big Data and AI, and ensuring that vulnerable groups find their place in the evolving global community.

While identifying SSA's vulnerabilities, the study could benefit from proposing data-driven solutions for developing trustworthy and inclusive AI policies in SSA. The scarcity of high-quality, representative data crucial for training AI systems unique to SSA's socioeconomic ecosystem remains a challenge and a motivation for future work. Our work would be strengthened by incorporating data or case studies to support its claims about vulnerabilities and the importance of equitable access. Overall, the study offers a valuable starting point for discussion but would benefit from further development and a more solution-oriented approach.

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