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INSTITUTE
WOMEN LEADING RESEARCH IN AFRICA

EMERGING TRENDS IN RESEARCH

SECTOR BRIEFS
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TABLE OF CONTENTS

Introduction	3
Sector Briefs	4
Climate Change, Natural Resources, and The Environment	4
Regional Contexts	5
Gender, Rights, and Governance	7
Information and Technology	11
Indigenous Knowledge Systems	13
Key Stakeholders Across Sectors	16
Bibliography	20





INTRODUCTION

Mawazo Institute recently reviewed the admission criteria for its Fellowship programme in line with the emerging trends in African research. Previously, applications from women pursuing PhDs in both Science, Technology, Engineering, and Mathematics (STEM) and the social sciences, qualified for consideration, provided their research was relevant to Africa's development agenda. Selection for the finalists would then rely on the originality and potential impact of their work.

However, in early 2023, Mawazo Institute sought to develop an understanding of emerging priorities, needs, and areas of future growth in African research to better identify Mawazo Fellowship programme applicants pursuing high-potential research. To this end, Mawazo Institute carried out the following research tasks:

- Identified the thematic priorities of 39 institutions¹ financing research on the continent. Selected institutions included private philanthropies, science granting councils, government agencies, and multilateral organisations.
- Surveyed 20 African experts within the institute's network of contacts working across universities, research institutions, and the private, public, or voluntary sectors.
- Reviewed 11 reports and journal articles discussing trends in the topical and thematic focuses of publications produced by researchers based in Africa.

After carefully considering insights from these three data sources, Mawazo developed a classification of nine major themes of emerging interest in the ecosystem as follows: (1) Agriculture and Food Security; (2) Business, Trade, and the Economy; (3) Climate Change, Natural Resources, and the Environment; (4) Education and Pedagogy; (5) Energy and Engineering; (6) Gender, Rights, and Governance; (7) Information and Technology; (8) Life and Health Sciences; and (9) Mathematical and Physical Sciences. Among the nine themes, Climate Change, Natural Resources and the Environment, Gender, Rights, and Governance, and Information and Technology emerged as cross-cutting or overarching. That is, while they remained areas of emerging interest in their own right, they were also significantly represented in other thematic areas. For example, funders supporting agricultural research may emphasise the need for grant recipients to consider climate stress or experts interested in the future of Life and Health Sciences may express an interest in the application of machine learning technology to disease diagnosis. Additionally, the study noted that another cross-cutting area in the emerging trends was that of Indigenous Knowledge Systems, where experts are now deferring to indigenous knowledge and process to solve present and future problems and challenges on the continent.

In the following sector briefs, we discuss key contextual information in the four cross-cutting themes and provide a list of key stakeholders working across the four themes. The sectors highlighted in this report showcase emerging topics that resulted from a collaborative process initiated during the launch of Emerging Trends in Research in September 2023. We extend our gratitude to our partners for the valuable insights and expertise contributed by members of RISA, Mastercard Foundation, IPA, FCDO, NAWI, and AWLN, along with the input of our Mawazo Fellows and Alumni. These sector briefs offer high-level overviews of significant challenges that not only demand innovation, but also steer research efforts in the coming years.

¹ Sources used to identify relevant institutions included Beaudry et al. (2018), Chataway et al. (2019), and The World RePORT database on biomedical research.



SECTOR BRIEFS

Climate Change, Natural Resources, and The Environment

The first cross-cutting theme is 'Climate Change, Natural Resources, and the Environment.' Climate change manifests in different ways across the globe, including but not limited to global warming, the evaporation of clean and drinkable water sources, and rising sea levels ('State of Climate in Africa Highlights Water Stress and Hazards', 2022). In Africa, there is further evidence of harsher droughts, increasing food and water insecurity, and uncertain weather patterns (State of the Climate in Africa 2021, 2022). These changes have also come with profound losses in environmental health and global biodiversity, with some ecosystems being wiped out entirely or altered in ways that are yet to be wholly understood (Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2019). Climate, like gender, is poised to become a key multi-disciplinary issue in research as we enter a world plagued by what the 2023 IPSOS Global Trends report terms a "polycrisis". This describes a situation where multiple global crises intertwine and their causes and effects compound, exacerbating already challenging circumstances (Carmichael et al., 2023).

Any discussion of climate change and conservation in Africa must address a complicated context. First, there is the issue of industrialised countries with the power and responsibility to take and dictate climate action. However, developing countries, including those in Africa, appear to have little locus standi to propose solutions on the world stage despite bearing the heaviest brunt of climate change (Abimbola et al., 2021). As Overland et al. (2021) have argued, Africa has only contributed a small fraction of global greenhouse gas emissions, yet it faces disproportionate risks from climate change. This imbalance is one of many inequities associated with climate change and raises questions concerning the origin, distribution, and thematic prioritisation of funding for climate change research in Africa (Overland et al., 2022). For example, about 80% of funding for research into climate issues affecting Africa goes to institutions in developed countries, particularly in North America and Europe. Kenya and South Africa accounted for 2.3% and 2.2%, respectively. Conventional funding institutions have been concentrated in the Global North and set the agenda for research globally. Consequently, the funding opportunities and grants directed towards Africa come with specific thematic focuses, which are often speculative, requiring researchers to prioritise the funder's agenda and align themselves to the stipulated grant requirements. More so, researchers in Africa are also subjected to the variability in funding availability and the vagaries of partners and funders in the Global North. This unequal funding relationship affects research design and dissemination and reduces African research capacity and local expertise to implement research findings.



SECTOR BRIEFS

Second, conservation initiatives and research have a complicated history on the continent. Traditional approaches to conservation are steeped in harmful, colonial practices (Domínguez & Luoma, 2020; Kashwan et al., 2021) and often refuse to cede to indigenous communities whose knowledge and practices have an established record of successfully preserving biodiversity (ICCA Consortium, 2021). A surveyed African expert in both climate change and gender equality (Personal Communication, February 2023) concurred that “leadership models and movement building that focus on undoing some of the negative systems in conservation—colonialism, patriarchy and racism” are a growing area of research in this space. In light of these issues, it is vital to have African-led and Africa-centred perspectives that challenge old approaches and align with the interests and values of local communities. It is fitting, therefore, that the priorities and interests of stakeholders in Africa’s research ecosystem should not only focus on the conservation of environments and ecosystems, but also address the need for community-led inclusive conservation efforts that consider the contributions of women and youth. This fact was clearly highlighted by African experts surveyed by Mawazo, that “[There] is a focus on inclusion and equity and elevating both indigenous voices and women community led/owned conservation” (African expert in climate change and gender equality, personal communication, February 2023). This was reiterated by another African expert working at the nexus of climate change and gender equality, who states (personal communication, February 2023) that “community-led, alternative models of participatory conservation” are an emerging trend of research.

Regional Contexts

In the past six decades, Africa has witnessed a warming trend that surpasses the global average (World Meteorological Organisation, 2022). Extreme climate events such as tropical cyclones, heat waves, prolonged drought, heavy rains and floods have become familiar occurrences throughout the continent. While the Horn of Africa continuously experiences prolonged and severe droughts, Southern Africa grapples with an unprecedented series of cyclones, resulting in flooding and substantial losses in lives and property. In the Sahel, numerous areas encounter significant flooding during the monsoon season with Niger, Chad and the southern part of Sudan severely affected. These extreme climate events have led to devastating impacts on communities, with serious long-term social, economic and political implications across Africa.

With the anticipated escalation of climate change in the next century, it is predicted to emerge as a leading contributor to the loss of African ecosystems and biodiversity, alongside intensified land use (Sintayehu, 2018). It is no longer in contention that the continent will experience changing biodiversity and ecosystem services. However, these ecosystem and biodiversity losses will manifest in region-specific changes, with some areas experiencing the negative impacts of climate change with high certainty (Müller et al., 2014). For instance, the rise of waters in saline Lake Bogoria in Kenya’s Rift Valley has led to alkalinity that threatens production of the blue-green algae that attracts the lesser flamingo to the lake (World Wildlife Fund, 2019). This portends dire consequences, as lesser flamingos have fled to nearby lakes due to pollution, drought, and climate change (Githaiga, 2022). Furthermore, climate change and biodiversity loss are affecting food and water systems across the continent. Entire food systems, including native crops and seed breeds, are disappearing due to global warming, climate change, and land degradation caused by fertiliser overuse (FAO, 2021).



SECTOR BRIEFS

More than 300 million people in Africa lack reliable access to safe drinking water and sufficient sanitation, making it the region with the lowest water supply coverage globally (Nkomo et al., 2006). Rising temperatures are further limiting the availability of fresh water directly (State of the Climate in Africa 2021, 2022) and, in some cases, indirectly through the after-effects of other climatic crises. For example, in East Africa, glaciers on Mount Kenya, Mount Kilimanjaro, and the Ruwenzori Mountains have been disappearing, thereby threatening fresh water supply that sustains many downstream communities and ecosystems (Veettil & Kamp, 2019).

Similarly, climate change is likely to adversely affect GDP per capita across the continent as agricultural yields suffer from depressed rainfall and shrinking water sources (Intergovernmental Panel on Climate Change, October 2022) and tourist attractions are affected by hotter weather (Hoogendoorn & Fitchett, 2018). We may also witness poor educational outcomes among children as farmers lose the income needed to pay for their children's education. Furthermore, extreme weather may lead to reduced school attendance (Global Center on Adaptation, 2022), while malnutrition and undernourishment will impact children's cognitive development and learning (Trisos et al., 2022).

Sixty percent of Africa's population is expected to reside in urban centres by 2050. Currently, approximately 59 percent of the continent's urban dwellers live in informal settlements, and the number is expected to increase substantially (Trisos et al., 2022). Life in informal settlements means poorer mental and physical health, inaccessible water and sanitation, and less security for the inhabitants. A 2020 study on Kenya's urban informal dwellings and congested high-rise dwellings showed higher instances of diseases such as rickets due to a lack of playgrounds, resulting in poor bone development in children's formative years (Edwards et al., 2014). Without improving the unfavourable urban living conditions, residents will face serious climate vulnerabilities such as poor nutrition, hidden hunger, stunted growth in children, and general poor conditions for wellness and health across all age groups.

Evidence suggests that higher temperatures, shrinking freshwater resources, frequent and prolonged droughts and food insecurity may already be escalating conflict in Eastern and Central Africa. Incidences of violence among pastoralist communities are increasingly common, as are conflicts over food and water sources. Further, politicisation of resources exacerbates violence in conflict-prone areas without early-warning systems in place (State of the Climate in Africa 2021, 2022).

Finally, climate change is threatening Africa's heritage. A case in point is West Africa, where preliminary studies have identified 10 cultural sites and 15 natural coastal heritage sites likely to be physically exposed to rising sea level by 2100 under the highest-warming scenario (Trisos et al., 2022c). Elsewhere in Southern Africa, the Marrromeu Game Reserve in Mozambique and the Seal Ledges Provincial Nature Reserve in South Africa are threatened by climate change (Trisos et al., 2022). Environmental degradation is also putting at risk traditional cultures, lifeways, languages, and knowledge systems (Sanago, 2022). There is a need for research and innovation to mitigate these losses and protect indigenous knowledge systems for future generations.



SECTOR BRIEFS

Other compound risks are expected to emanate from climate change across the continent, including increased heat-related mortality, losses in labour productivity, and flooding from rising sea levels (Intergovernmental Panel on Climate Change, October 2022). From this, we can infer that current livelihood strategies and future development actions will be drastically impacted by climate change. African scholars are at a crucial juncture in identifying the heterogeneous nature of climate change across the continent, conceptualising development and adaptation strategies, and providing support to African societies in adapting to climate change. However, it is noteworthy that most available literature significantly fails to highlight the impact of climate change on women, children, and persons living with disabilities (PLWDs) across the continent. With few studies adopting an intersectional lens, climate change adoption policies in Africa are prone to worsening inequalities among social groups. Consequently, these policies may fail to address the distinct needs of individuals within specific contexts (Clement et al., 2019; Ndabaningi et al., 2023). Therefore, any mitigation, adaptation, and conservation efforts that refuse to explicitly address the plight of these vulnerable groups and other marginalised people, will not adequately address climate change.

Gender, Rights, and Governance

There were notable differences across the three data sources consulted to generate the list of emerging themes in African research. For example, while research funding institutions supporting work on 'Gender, Rights, and Governance' appeared to be interested in anti-corruption as an issue, neither the African experts surveyed nor the bibliometric research reviewed revealed the same interest. In fact, gender equality was one of the few shared areas of interest. However, as global challenges become increasingly interrelated, efforts to address gender disparities have become inextricable from efforts to address other urgent issues in governance and beyond (Foresight Africa: Top Priorities for the Continent in 2023, 2023). Continental policy commitments reflect this reality, with strategic documents from the African Union (AU) recognising the difficulties in eliminating gender inequality without transforming education, economics, conflict resolution, political institutions, and other attendant socio-economic and political dynamics (African Union Commission, 2018).

Despite this commitment and the meaningful progress towards addressing issues such as child marriage, female genital mutilation, and the political underrepresentation of women (Azcona et al., 2022), sub-Saharan Africa ranks 6th out of the eight regions evaluated in the Global Gender Gap Report. Estimates from different indexes suggest it could take between 100-140 years to achieve full gender parity (Global Gender Gap Report 2022: Insight Report, 2022; Moodley et al., 2019). This sector brief aims to articulate some of the key contributing factors to the situation.



SECTOR BRIEFS

Mawazo's research reveals three key governance barriers to attaining gender equality in Africa in general. First, electoral structures in the region are failing to represent and serve women equally, thereby creating gaps in power and decision-making that may slow down efforts to dismantle gender inequality (Foresight Africa: Top Priorities for the Continent In 2023, 2023). For example, despite more women assuming parliamentary seats on the continent (Global Gender Gap Report 2022: Insight Report, 2022), in 2021 women comprised only 7 percent of presidents or vice presidents and 22 percent of cabinet members (Morna et al., 2021), against global averages of 14 and 22 percent, respectively (Azcona et al., 2022). Interestingly, while women make up 34 percent of local decision-making bodies globally, the continent matches or exceeds this average, with East Africa leading with an enviable 35 percent of women in local government positions. (Azcona et al., 2022; Morna et al., 2021). An AU member state's commitment to Agenda 2063 notes that women should be "equally represented in all areas of decision-making, at all levels" (African Union Commission, 2018). This continued under-representation may have profound social impacts; for instance, at a time of democratic backsliding on the continent (Makunya et al., 2021), women may be a key constituency in the strengthening of democratic rights and institutions, in part through the power of feminist social mobilisation (Kioko et al., 2020; United Nations, 2022).

Second, gender-responsive budgeting remains manifestly weak, thereby failing to ensure that pro-inclusion initiatives receive the resources they require. Globally, only 26 percent of countries comprehensively track gender equality in public allocations, while 59 percent have some features of such a system (The Sustainable Development Goals Report 2022, 2022). In Africa, 30 countries, slightly over half the total, have gender-responsive budgets in place. This indicates a clear consensus that gender budgeting not only contributes to the well-being of women but also the welfare of society as a whole. However, to make further progress, more countries will need to emulate the leaders in gender-responsive budgeting, such as Rwanda, where radical changes to fiscal policies and budget-making procedures were embraced (Foresight Africa: Top Priorities for the Continent in 2023, 2023).

Finally, Mawazo's research revealed that the world lost up to \$1 trillion in GDP due to the digital exclusion of women in 2022. This makes it imperative to realise the AU's commitment to making women and girls active users and shapers of technological solutions (African Union Commission, 2018; Azcona et al., 2022). Collectively, these interventions may accelerate the meaningful inclusion of women across societies at a time of rapid social and technological change.

Importantly, Mawazo's consideration of relevant research also reveals at least three crucial failures in comprehensively including women across the full range of social settings. First, while real progress has been made towards reducing or eliminating disparities in primary education on the continent (OECD, 2021), Africa continues to have the largest gender gap in educational attainment (Global Gender Gap Report 2022: Insight Report, 2022). The continent has also not succeeded in improving the conditions of doubly marginalised groups, such as girls from poor households or those living with disabilities (Azcona et al., 2022). In addition, persistent inequalities at higher levels of education continue to contribute to lower lifetime economic opportunities (OECD, 2021), with women making up 43 percent of Africa's tertiary graduates but only 23 percent of its top business leaders (Moodley et al., 2019). For example, only 24% of academic staff across sub-Saharan Africa in tertiary education are women (UNESCO, 2019), and women who receive tertiary education are 43% but hold only 28% of formal sector jobs (McKinsey Global Institute, 2019).



SECTOR BRIEFS

Second, and intimately connected to ongoing inequalities in education, women continue to be significantly excluded from economic life, potentially costing the region up to USD 340 billion in lost income (Global Gender Gap Report 2022: Insight Report, 2022). In fact, 63 percent of the 380 million women and girls globally who are likely to experience inadequate housing, poor sanitation, limited healthcare access, and limited job opportunities due to extreme poverty, are in sub-Saharan Africa (Azcona et al., 2022). This is despite Africa making significant progress in closing the gender gap in economic participation, in part due to recent improvements in earned income parity. More so, African women are at a further disadvantage concerning lifetime wealth accumulation due to pay gaps, unequal career trajectories (Foresight Africa: Top Priorities for the Continent in 2023, 2023), and fewer rights to land, assets, and financial services as a result of discriminatory laws and practices (OECD, 2021).

An expert in agriculture and field security (Personal Communication, February 2023) reported on the growing need to “[involve] youth and women in mitigation and empower women especially on climate issues that tie up to food security and health.” Poor women in Africa still lack access to key natural resources such as fuel wood and potable water despite being their principal consumers (Tantoh et al., 2021), thereby depriving them of economic opportunities and, potentially as a result, leaving them more likely than men to experience food and water insecurity (Azcona et al., 2022).

At a time of increasing geopolitical instability, there is a need to better understand and address the challenges facing women who are living through conflict or have fled conflict situations. Globally, more than 500 million women and girls live in fragile and conflict-affected countries. Female migrants and refugees bear the brunt of conflicts, experiencing extreme conditions and human rights violations, including gender-based violence. They are especially vulnerable to the forms of socio-economic exclusion aforementioned, with 54 percent of all “out of school” girls globally living in crisis-affected countries (Azcona et al., 2022). It is crucial that more African women researchers intervene in this area, given the fact that a quarter of the 12.4 million female refugees globally are from sub-Saharan Africa (Azcona et al., 2022). There is inadequate research on the experiences of African women in humanitarian or crisis situations, including neglect, water access, education, intersectional experiences, reintegration, economic opportunity, and resource control (Maina, 2012; Nwoke & Cochrane, 2022).

The research further reveals that gender equality is hindered by persisting gaps in legal and social commitments to respect women’s bodily autonomy and physical safety. While most African countries have ratified international treaties on gender equality such as the Protocol to the African Charter on Human and Peoples’ Rights on the Rights of Women in Africa (the Maputo Protocol), the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), and the ILO Equal Remuneration Convention, at the national level, there has been uneven adoption of constitutional and legislative measures providing for women’s economic rights, political participation, and protection from harmful cultural practices and gender-based violence (African Union Commission, 2021). While progress has been made, challenges remain to fully implement gender equality on the continent. Of the 55 member states of the African Union, only 44 have ratified the Maputo Protocol, hindering its effective implementation across Africa. Furthermore, entrenched patriarchal systems and cultural norms persistently impede progress in numerous countries. At current rates of progress globally, it could take almost three centuries to eliminate legal gaps and discriminatory laws (Azcona et al., 2022).



SECTOR BRIEFS

Research plays a pivotal role in addressing these challenges by providing evidence-based insights that align with local needs, inform policy changes and ensure systemic approaches with a feminist lens. Through enhancing the involvement of African researchers, this will encourage a diversity of research efforts that will highlight the importance of gender-inclusive policies, and guide the development of strategies to accelerate the process. Collaborative efforts between researchers, policymakers and advocacy groups can foster meaningful exchange towards achieving gender equality in Africa.

African women's access to sexual and reproductive health rights (SRHR) is low and has worsened due to disruptions in health systems caused by the COVID-19 pandemic. According to Kipruto et al. (2023), the COVID-19 pandemic and particularly the mitigation policies that followed, had detrimental effects on sexual and reproductive health services and threatened to undo the progress made towards the Sustainable Development Goals. The reduced or delayed access and utilisation of healthcare services will likely have long-term effects for young girls, women and the entire healthcare system. Evidence suggests that in sub-Saharan Africa, 15,000 preventable deaths occur annually as a result of 6.2 million unsafe abortions (Center for Reproductive Rights Africa Program, 2023). This is a likely indication that despite recent progress towards liberalising laws on abortion (Cascais, 2022), Africa appears to reflect the failures that have led to sobering global statistics. Available figures indicate that countries have (on average) about 76 percent of the legal infrastructure necessary to guarantee full and equal access to SRHR. However, only 57 percent of women aged 15–49 make their own decisions about sexual relations and reproductive health care (African Union Commission, 2018), while 1.2 billion women and girls live in countries with restrictions on access to safe abortion (Azcona et al., 2022). Beyond alarming health-related concerns, there are dire economic consequences facing young girls and women: the deepening of poverty, including the feminisation of poverty and the exposure of young women and girls to disproportionate rates of social and economic risk, which has the potential to reverse any progress made towards attaining gender equality (Kipruto et al., 2023).

Finally, despite AU commitments to reduce violence against women and protect their physical integrity (African Union Commission, 2018), coupled with public declarations against female genital mutilation (FGM) across communities, the coverage and quality of legal protections in these areas remain generally poor (OECD, 2021). In sub-Saharan Africa, 43 percent of women have experienced some form of gender-based violence in their lifetime (OECD, 2021) and 10 countries in the region are among the 15 with the worst rates of intimate partner violence globally (Foresight Africa: Top Priorities for the Continent In 2023, 2023). At least one in four women in the region aged 15–49, has suffered female genital mutilation. While Africa may reflect similar global patterns of violence against women that lead to death by family members, violence by partners, and vulnerability to female genital mutilation at alarmingly high rates, the region must do better if it hopes to eliminate gender inequality (Azcona et al., 2022; The Sustainable Development Goals Report 2022, 2022).



SECTOR BRIEFS

Information and Technology

The third overarching theme is ‘Information and Technology’, which spans the creation, development, and implementation of information and communication technologies. In this domain, emerging issues identified include technological innovation, cyberinfrastructure and computing, and leveraging technology in job markets, among others. However, the key emerging issue addressed across datasets was artificial intelligence and machine learning, especially its potential to promote development and more diverse and inclusive online environments for Africans and innovation. A surveyed African expert working in the field of information and technology and financial systems (personal communication, February 2023) said the following about this emerging research trend:

Without a doubt, there are advancements in Chat-GPT, its counterparts and generative AI as a whole. The barrier to entry is lower than ever before, and we're seeing a lot of promise in the application of these technologies. There's tremendous opportunity in this space. From individuals who want to boost their productivity, to companies who want to leverage it to improve their experiences, and also whole industries and supply chains, it's certainly worth the hype and attention it's been getting.

This interest reflects the fact that we are currently in a transformative digital age, sometimes referred to as Industry 4.0 or the Fourth Industrial Revolution (4IR), characterised by the rise and dissemination of frontier technologies such as artificial intelligence (AI), machine learning (ML), the internet of things (IoT), robotics, and blockchain technology (Ngila, 2022). These technologies promise to change our social and economic lives, raising important questions about equity, inclusion, and governance. Already, generative artificial intelligence that mimics the human ability to dynamically respond to new tasks in some specific settings (Baum & Villasenor, 2023) has been identified as a potential threat to millions of jobs in both the Global North and Africa (Gwagwa et al., 2020; OECD, 2023). Experts estimate that generative AI such as OpenAI's ChatGPT, which has demonstrated its ability to generate content that is nearly indistinguishable from human-generated content, may automate over 300 million jobs (Kodnani & Pierdomenico, 2023). According to some reports, approximately 46 percent of jobs in the administrative industry and around 44 percent in the legal profession in the United States and Europe are at risk of being taken over by AI, or, at the very least, experiencing increased threats to job security due to its adoption (Vallance, 2023). There is a real possibility that the impacts in the developing world will be even more severe. The Africa Development Bank (2019) predicts that by 2030, approximately 100 million African youth will be unable to find gainful employment, with technological advancements in artificial intelligence and machine-learning cited as part of the cause of job scarcity.



SECTOR BRIEFS

As the rest of the world rushes to seize the opportunities AI presents for enhancing productivity, Africa must ensure that it is not left behind. Developing countries are at risk of losing out on the current digital revolution and must invest in human capital and infrastructure to close existing information and technology gaps (Adams, 2022), but doing so in a way that retains unique African perspectives on responsible AI (Kiemde & Kora, 2022). Researchers in Africa are actively creating AI tools to tackle the most urgent problems and challenges on the continent, demonstrating a nuanced understanding of local contexts. However, there exists a necessity to narrow the divide between these researchers and policy actors in the AI tech sector in Africa. Policy actors often lack awareness of the significant work conducted by researchers and the critical role such research plays in shaping public policy agendas. Additionally, in governmental discussions, AI technology is not frequently prioritised as a primary concern. Closing this communication gap is vital for fostering collaboration and ensuring that AI research informs and aligns with policy initiatives in Africa. Presently, only two countries in Sub-Saharan Africa, South Africa and Mauritius, sit in the “Upper Middle” category of the Readiness for Frontier Technologies Index. The rest of the countries in the region are in either the low or lower middle categories, making the continent as a whole the least prepared to use, adopt, and adapt to frontier technologies during the fourth industrial revolution (UNCTAD, 2023).

Key gaps on the continent include poor institutionalisation of digital capacity building, lagging (but growing) uptake of internet and mobile technology (Bhorat et al., 2023), and highly unequal access to connectivity across countries and urban-rural divides (Krönke, 2020). Another example is the need to train AI models such as Large Language Models (LLMs) and Natural Language Processes (NLPs) on local knowledge and local languages and localise technology. A crucial first step, therefore, will be finding means of solving these challenges and upskilling workforces on the continent to take advantage of emerging opportunities. It will also be important to take advantage of the potential of artificial intelligence technology in public service delivery. As of now, many African governments remain unprepared to implement AI in their public service delivery systems (Rogerson et al., 2022).

On the other hand, there are further concerns brought about by Africa’s technological advancements. These perspectives must be critically analysed through an African lens, as artificial intelligence adoption without objective assessment may deepen inequalities and biases already prevalent on the continent (Wairegi et al., 2021). Artificial intelligence, if left unchecked, may affect communities and perpetuate harmful social hierarchies, particularly reflected in gender bias in recruitment and healthcare systems as well as ethnic and racial bias reflected in criminology software and public services systems. Other concerns raised by activists and scholars alike include increased utilisation of AI surveillance systems to repress citizens and quell social movements (Feldstein, 2019).



SECTOR BRIEFS

If the digital transition is effectively and inclusively managed, Africa could manage to address chronic youth unemployment and seize the potential of its demographic dividend (Choi et al., 2020). The continent is still the youngest in the world, with a median age of 19.7 (Rocca & Schultes, 2020), but a whopping 60 percent of its youth are currently unemployed (Abisoye, 2021). With the population of young people in Africa expected to double by the year 2055, it is essential to effectively manage their incorporation into the emerging digital economy to tackle both urban poverty and youth unemployment (United Nations Department of Economic and Social Affairs, Population Division, 2022). However, there is also a need to decouple youth and women and their use of artificial intelligence. Further research is needed to explore the ways in which women utilise and integrate AI, broadening the understanding of women's roles and the potential applications of AI within their professional environments. Moreover, women are involved in diverse fields of employment, spanning from agriculture to business, presenting opportunities for their active involvement. For example, women in agriculture can harness educational technology (ed-tech) to impart knowledge about agricultural practices, while those in business can enhance their earning potential by leveraging AI tools to acquire marketable skills.

In conclusion, AI and other fourth industrial revolution technologies in Africa have largely been driven by the private sector, with public sector institutions struggling to create facilitating environments, establish regulations, or adopt fourth industrial revolution technologies themselves. To remain competitive in the long run, Africa will need to deepen its capacity to nurture innovative home-grown information technology companies that use technology to solve some of the continent's most pressing development challenges (Disrupt Africa, 2022). It will also be crucial for African governments to take urgent steps towards implementing policies around AI. To date, only Mauritius, Egypt and Kenya have developed national AI strategies (Rogerson et al., 2022). A more concerted effort is required beyond the individual initiatives of AI experts in Africa. For instance, governments can implement education policies, such as introducing coding for all children. As part of this process, African governments will need to consider establishing mechanisms for transparency and democratic accountability to successfully incorporate frontier technologies and achieve development goals (Plantinga, 2022).

Indigenous Knowledge Systems

The final overarching theme, 'Indigenous Knowledge Systems' draws from the understandings, skills and philosophies developed by societies with long histories of social cohesion and cultural connectedness with nature, including a deep understanding of science, the cosmos, medicine, and biodiversity. Awareness of indigenous ways of sustainable living and the rapid deterioration of the environment have recently piqued the interest of international communities in indigenous knowledge and practices. Disciplines such as ecology, land and natural resources management, biodiversity and environmental conservation, health and education are among those influenced by the increasing use of indigenous knowledge (Magni, 2017). Upon careful review of the data analysed for this report, it becomes apparent that African Indigenous Knowledge research follows a trajectory analogous to global patterns. The data indicates that Indigenous Knowledge is inherently multidisciplinary, as evident across all the themes. Additionally, with multiple thematic areas, sub-themes emerge, effectively addressing and encompassing issues identified in Indigenous Knowledge research on the continent.



SECTOR BRIEFS

Mawazo's research indicated four main areas of interest in Indigenous Knowledge systems. In the Climate Change, Natural Resources and Environment thematic area, there was interest in conserving and managing ecosystems. Indigenous people are known to be the custodians of biodiversity and are engaged in biodiversity conservation. They possess an extensive understanding of the dynamics of intricate ecological systems within their localities, maintaining historical consistency in their practices of utilising resources (Mekonen, 2017). However, adverse ecological changes as a consequence of climate change and biodiversity loss directly affect their territories and their ways of life. In spite of their heightened vulnerability and awareness, indigenous peoples and local communities are proactively addressing climate change, demonstrating remarkable resourcefulness. For instance, according to the UNESCO (2017) Local Knowledge, Global Goals report, the inclusion of indigenous knowledge enhances climate science by providing detailed observations and interpretations on a more precise spatial scale and with significant temporal depth. Recent research has demonstrated the immense significance of indigenous knowledge, not only in averting or alleviating the impact of natural disasters, but also in the realms of early warning, preparedness, response and post-disaster recovery (Rautela & Karki, 2015).

Closely related to the management of natural resources and ecosystems, research on Indigenous Knowledge has focused on various aspects of agriculture and land use, where farmers have implemented indigenous knowledge skills, practices and systems for agricultural production and the conservation of natural resources (Akullo et al., 2007). For centuries, indigenous peoples have carried out specific practices that are adapted to their lands. Their various practices are viable and sustainable, including rotational farming, shifting cultivation, pastoralism and agroforestry, to name a few (International Indigenous Peoples' Summit on Sustainable Development, 2002). However, with the escalating demands for food production and intensified land utilisation, certain highly effective indigenous agricultural knowledge has either not been adequately documented or has been supplemented by modern techniques. Nonetheless, recent research on agriculture and food security attests to indigenous agricultural knowledge as a powerful tool for agricultural development. There is a recognised necessity to foster indigenous technologies and knowledge within modern agriculture research, emphasising the documentation of such knowledge as a contemporary form (Melash et al., 2023).

Upon a bibliometric review of the Life and Health Sciences thematic area, indigenous knowledge and health presented a distinctive area of interest. According to the World Health Organisation (2019), indigenous medicines in Africa are used for health, socio-cultural and economic reasons, and close to 80% of the population in Africa uses indigenous medicine as the primary source of healthcare. Across the continent, indigenous traditional healers play a crucial and acknowledged role in the healthcare system. They participate in various practices, identifying themselves as herbalists, spiritualists and mediums, or a blend of these practices (Bardsley, 2017). For example, in Southern Africa, there is extensive research on the role of traditional doctors as cultural authorities and their relevance to HIV/AIDS-related strategies and interventions that are culturally sensitive (Levers, 2006). Researchers are urged to advocate for collaborative initiatives between the biomedical and indigenous medicine communities, as well as critically assess the stigmatisation of African traditional healing.



SECTOR BRIEFS

Globally, there are increased efforts to solidify the presence of indigenous knowledge as a concept of interest and increase its popularity in the academic space (Malapane et al., 2020). A surveyed African expert on Education and Pedagogy reflected on decolonising knowledge production and indigenous knowledge systems as emerging trends in African research. Owusu-Ansah and Mji (2013) state that science, knowledge and its methodologies cannot be separated from people's history, cultural context and worldviews. Therefore, Malapane et al. (2020) argue for the questioning of education and the decolonization of school curriculums, languages and indigenous methodologies. While we can acknowledge the contributions of Western knowledge systems to the development of modern Africa, there is a need to focus on self-reliant productions of knowledge that meet both the material and intellectual needs of our African societies (Hountondji, 2011). Future research should adopt an Afrocentric paradigm that is suitable for African research. This involves the utilisation of emancipatory and participatory research methods that value and include indigenous knowledge and communities (Malapane et al., 2020).

Indigenous Knowledge Systems possess the transformative potential to impact various facets of our societies, ranging from agriculture and environmental management to medicine and health, language and art (Kwanya, 2015). It has often been assumed that indigenous knowledge systems diverge from conventional scientific paradigms, yet they exhibit dynamism and an ability to continually evolve, heavily influenced by both internal innovation and experimentation, alongside interactions with external systems. In light of this, it is essential to recognise that African indigenous knowledge systems transcend the negatively connoted boundaries of 'traditional', contributing to the advancements of science and technologies, cosmologies and astrophysics, indigenous governance and leadership systems, entrepreneurship and beyond. Examples such as the innovative integration of African Natural Medicines (ANMs) with classical medical systems derived from ancient African and Chinese cosmologies (Chabalala et al., 2021) and the nuanced understanding of indigenous knowledge in urban design fostering community dialogue (Mbeche, 2009; Mwendwa, 2001), underscore the breadth and significance of indigenous wisdom. Embracing and harnessing the richness of indigenous knowledge systems can pave the way for holistic advancements across diverse sectors, driving innovation and sustainable development across the African continent.



SECTOR BRIEFS

Key Stakeholders Across Sectors

The table below encapsulates an overview of key stakeholders spanning across the thematic areas who provide research grants, seed funding, fellowships and/or scholarships. This compilation aims to shed light on the pivotal actors influencing sectors such as government, business and startups and non-profit organisations.

Institutions providing research grants, seed funding, fellowships, or scholarships	
Organisation	Relevant sectors
<p><u>(United Nations Department of Economic and Social Affairs, Population Division, 2022)</u></p> <p>A feminist philanthropic organisation that aims to provide unrestricted, flexible, and multi-year grants to local initiatives and organisations advancing gender justice, especially historically marginalised groups. It does not fund research, government entities, or political activities, but applying groups do not need to be registered non-governmental organisations (NGOs) to qualify.</p>	<p><i>Gender, rights, and governance</i></p>
<p><u>Women's Economic Empowerment and Digital Finance (WEE-DiFine)</u></p> <p>A research initiative that seeks to generate a comprehensive body of evidence that addresses the impact of digital financial services (DFS) on women's economic empowerment (WEE) by funding rigorous research across South Asia, Sub-Saharan Africa, and Southeast Asia. It awards large grants, of between USD 200,000 and 500,000 for large-scale greenfield evaluations or extensions to existing studies, and small grants of USD 50,000 for measurement, qualitative, and pilot studies.</p>	<p><i>Gender, rights, and governance</i></p> <p><i>Information and technology</i></p>
<p><u>Women Entrepreneurship for Africa (WE4A)</u></p> <p>A program implemented by the Tony Elumelu Foundation focusing on increasing access to funding, markets, and entrepreneurial training for underserved communities in sub-Saharan Africa, including women, youth, and those in the informal sector. The Acceleration/Growth Programme will be implemented with support of SAFEEM (Swiss Association for Entrepreneurship in Emerging Markets).</p>	<p><i>Gender, rights, and governance</i></p>
<p><u>The African Development Bank (AfDB) 4IR Fund</u></p> <p>A grant facility worth USD\$100 billion that aims to raise financing and mobilise partnerships to support digital transformation in Africa by providing access to digital infrastructure, improving digital services in both the public and private sector, stimulating digital skills development, scaling digital innovations, and crowd-in investment to empower technology-enabled start-ups (especially those benefiting youth, women, and the rural economy). It also aims to support the creation of an enabling policy environment.</p>	<p><i>Gender, rights, and governance</i></p> <p><i>Information and technology</i></p>



SECTOR BRIEFS

<p><u>IDRC/SIDA Artificial Intelligence for Development (AI4D) in Africa</u> A grant facility worth CAD\$20 million to support the African-led development of responsible and inclusive AI. It aims to partner with data scientists and policymakers to seize AI's ability to promote sustainable development priorities such as improving food systems, enabling high quality education, and tackling health and climate challenges while also creating the policies and practices needed to prevent the technology from reinforcing structural inequalities and bias, perpetuating gender imbalances, threatening jobs, and facilitating government surveillance.</p>	<p><i>Gender, rights, and governance</i></p> <p><i>Information and technology</i></p>
<p><u>African Centre for Technology Studies - Artificial Intelligence for Development (AI4D) in Africa Scholarship Programme</u> A training and professional development programme that provides registered PhD students, early career academics, and post-doctoral fellows in Africa with grants worth USD\$68,000 to conduct research and undertake capacity building in artificial intelligence and machine learning.</p>	<p><i>Information and technology</i></p>
<p><u>Keepers of the Earth Fund</u> An indigenous-led culture fund which is designed to support Indigenous Peoples' community advocacy and development projects. The Keepers of the Earth Fund (KOE) awards grants of up to \$12,000 USD, which go directly to traditional Indigenous communities, collectives, organisations, and governments, to support their self-designed development projects based on Indigenous values.</p>	<p><i>Indigenous Knowledge Systems</i></p>
<p><u>IFAD - Indigenous Peoples Assistance Facility (IPAF)</u> An innovative funding instrument that indigenous communities can use to find solutions to the challenges they face. The objective of the Facility is to strengthen indigenous peoples' communities and their organisations. It finances small projects that foster self-driven development.</p>	<p><i>Indigenous Knowledge Systems</i></p>
<p>Institutions providing professional development training or resources</p>	
<p>Organisation</p>	
<p><u>African Women's Leadership Institute (AWLI)</u> A programme dedicated to shaping transformative, young feminist leaders and an initiative of Akina Mama wa Afrika (AMwA), a pan-African, NGO. The AWLI offers short courses on feminist leadership to African women from various sectors of the economy to build a wider constituency of leaders able to articulate women's concerns with structures and systems that hinder gender equality. It also provides a one-year mentorship programme after the training to ground participants on deeper feminist principles.</p>	<p><i>Gender, rights, and governance</i></p>
<p><u>Zamara Annual Intersectional Feminist Leadership Institute (ZaFLI)</u> An annual intersectional feminist institute organised by the Zamara Foundation in Nairobi, Kenya. It aims to provide young East African women leaders aged 18-35 with the training and exposure necessary to build a constituency of young feminists who understand how different power structures overlap to create experiences of discrimination based on gender, class, sexuality, ethnicity etc.</p>	<p><i>Gender, rights, and governance</i></p>



SECTOR BRIEFS

<p><u>Peace & Security Fellowships for African Women</u> A programme designed by the African Leadership Centre (ALC), King's College London that brings together African women at the early stages of their careers for a training programme in Leadership, Development and Security. The Fellowships are designed to practically increase the involvement of women in human rights and development issues and to challenge traditional discourses on conflict and security.</p>	<p><i>Gender, rights, and governance</i></p>
<p><u>The African Climate Foundation Fellowship (ACFF)</u> The ACFF supports placements in regional, national, and academic institutions (as well as leading African NGOs and think tanks) for mid-career African professionals, practitioners, and academics working at the intersection of climate change and development. Through this program the African Climate Foundation seeks to move both policy development and research on the continent towards support for evidence-based approaches to climate change, economic development, and economic diversification in Africa.</p>	<p><i>Climate change, natural resources, and the environment</i></p>
<p><u>The DAAD climapAfrica Programme</u> The DAAD climapAfrica programme aims to foster application-oriented research to tackle climate change in southern and western Africa. The programme funds postdoctoral research projects and supports collaboration in thematic working groups composed of postdoctoral fellows and African alumni of German funding initiatives with expertise in the field of climate research. The programme aims to improve research impact and output through training in general skills, science policy advisory, and science management. To complement this, working groups serve as the foundation for an Africa-wide network of experts and practitioners.</p>	<p><i>Climate change, natural resources, and the environment</i></p>
<p><u>African Plant Breeding Academy (APBA)</u> The APBA is an initiative implemented by the Seed Biotechnology Center at the University of California Davis in collaboration with the African Orphan Crops Consortium, the African Union New Partnership for Africa's Development (NEPAD), and World Agroforestry Centre (ICRAF), among other partners. It is hosted in Nairobi, Kenya and aims to train practising African plant breeders in the most advanced theory and technologies for plant breeding (e.g., quantitative genetics, statistics, gene editing, etc.) in support of critical decisions for crop improvement.</p>	<p><i>Climate change, natural resources, and the environment</i></p>
<p><u>Microsoft Africa Research Institute PhD Fellowship</u> MARI aims to understand, build, and implement cloud and AI technologies that address Africa's development challenges and contribute to a more productive global future. Its PhD fellowship programme provides exceptional computing PhD students at African Universities with a three-month research internship at MARI in either Future of Work, Health Intelligence, or Machine Intelligence.</p>	<p><i>Information and technology</i></p>
<p><u>Google DeepMind Postdoctoral Fellowships</u> The DeepMind Postdoctoral Fellowship aims to increase representation in AI to make sure AI is built to benefit everyone. It provides early-career researchers with PhDs in machine learning, computer science, statistics, and other relevant fields with the opportunity to pursue postdoctoral study and build their expertise and research experience for future leadership roles. The program provides financial support, opportunities for mentorship from DeepMind researchers, and the chance to pursue post-doctoral work in the United Kingdom.</p>	<p><i>Information and technology</i></p>



SECTOR BRIEFS

<p>DAAD Ainet Fellowship A DAAD fellowship is awarded twice a year to outstanding international early-career researchers in artificial intelligence. Awardees are invited to join DAAD's networking program, the Postdoctoral Networking Tour in Artificial Intelligence, that offers participants the opportunity to meet leading AI researchers in Germany with the aim of building collaboration, research, and career opportunities. Awardees are also inducted into DAAD's network of alumni.</p>	<p><i>Information and technology</i></p>
<p>Professional associations and networks in the thematic area</p>	
<p>Organisation</p>	
<p>The African Women's Development and Communications Network (FEMNET) A Pan-African feminist and membership-based network that aims to ensure the voices of African women are amplified, and their needs and aspirations are prioritised in policy dialogues. It helps members (non-government institutions and individuals) share information and approaches on women's development and rights.</p>	<p><i>Gender, rights, and governance</i></p>
<p>Women in Law & Development in Africa – Africa de l'Ouest (WILDAF-AO) A Pan-African women's rights non-governmental organisation, and practitioner's network established in 1990 that aims to promote and strengthen strategies that link law and development to increase women's participation and influence in development at the community, national, and international, level. It has offices in 11 West African countries.</p>	<p><i>Gender, rights, and governance</i></p>
<p>Women in Dev A platform that connects and unites women working across all regions of the world in international development, health, and social justice. It is rooted in feminist principles and seeks to provide an environment for women to come together as leaders, advocates and allies across movements, networks, coalitions, initiatives, and organisations. Women in Dev works to transform funding practices, instil feminist leadership models, and increase women's leadership.</p>	<p><i>Gender, rights, and governance</i></p>
<p>National Adaptation Plan (NAP) Global Network A network of over 200 adaptation decision-makers and practitioners from over 150 countries working on national adaptation plans (NAP). It works to facilitate South-South peer learning and exchange, provides short-term and long-term technical assistance for NAP development and implementation, and develops knowledge products highlighting lessons and experiences from countries trying to advance their NAP process.</p>	<p><i>Climate change, natural resources, and the environment</i></p>
<p>AI Africa Consortium Led by the University of Witwatersrand, this is a consortium of universities, research organisations, and government agencies in Africa geared towards establishing world class AI research and capabilities on the continent.</p>	<p><i>Information and technology</i></p>
<p>Deep Learning Indaba Deep Learning Indaba is an annual meeting of the African machine learning and AI community that aims to strengthen African AI. Deep Learning Indaba is a week-long learning, research, exchange, and debate event that focuses on crucial issues in modern artificial intelligence.</p>	<p><i>Information and technology</i></p>



SECTOR BRIEFS

<p>Zindi An online social enterprise that aims to build a community of African data scientists working to solve pressing challenges experienced by companies, NGOs, and governments with machine learning and AI. It connects data scientists with organisations and provides them with a platform and tools to hone their skills, find jobs, and grow their professional networks.</p>	<p><i>Information and technology</i></p>
<p>Africa Indigenous Knowledge Research Network (AIKRN) The Africa Indigenous Knowledge Research Network undertakes research geared towards identifying, recentering and harnessing Indigenous knowledge in Africa. It is aimed at foregrounding the authenticity of African Indigenous knowledge through co-creation, collaboration, partnership with custodians of knowledge such as community elders, traditional leaders, rainmakers, and other gatekeepers of knowledge and the youth. It is also an innovative platform for fostering linkages between African indigenous knowledge systems with technology and other forms of knowledge from other regions of the world. The Network is interdisciplinary and multidisciplinary in scope and approach.</p>	<p><i>Indigenous Knowledge Systems</i></p>



BIBLIOGRAPHY

- Abimbola, O., Aikins, J. K., Makhesi-Wilkinson, T., & Roberts, E. (2021). Racism and Climate (In)Justice: How Racism and Colonialism shape the Climate Crisis and Climate Action. <https://us.boell.org/sites/default/files/2021-03/FINAL%20-%20Racism%20and%20Climate%20%28In%29Justice%20Framing%20Paper.pdf>
- Abisoye, T. (2021, December 8). The case for job creation hubs to reduce youth unemployment in Africa. Brookings. <https://www.brookings.edu/articles/the-case-for-job-creation-hubs-to-reduce-youth-unemployment-in-africa/>
- Adams, R. (2022, May 30). AI in Africa: Key Concerns and Policy Considerations for the Future of the Continent. APRI. <https://afripoli.org/ai-in-africa-key-concerns-and-policy-considerations-for-the-future-of-the-continent>
- Afiesimama, E., Baddour, O., Diouf, S., & Nkurunziza, R. S. (Eds.). (2022). State of the Climate in Africa 2021. World Meteorological Organisation.
- Africa Development Bank. (2019). African Economic Outlook 2019. Africa Development Bank Group.
- African Union Commission. (2018). AU Strategy for Gender Equality & Women's Empowerment, 2018-2028. African Union. https://au.int/sites/default/files/documents/36817-doc-52569_au_report_eng_print.pdf
- African Union Commission. (2021). Grassroots Approach to Gender Equality and Women's Empowerment 2010-2020. https://au.int/sites/default/files/documents/41992-doc-AWD_report_English_E.pdf
- Akullo, D., Kanzikwera, R., Birungi, P., Alum, W., Aliguma, L., & Barwogeza, M. (2007, August). Indigenous knowledge in agriculture: A case study of the challenges in sharing knowledge of past generations in a globalized context in Uganda. In World Library and Information Congress: 73rd IFLA General Conference and Council (pp. 19-23).
- Azcona, G., Bhatt, A., Brauchle, J., Fillo, G. F., Min, Y., Page, H., & Zhang, Y. (2022). Progress on the Sustainable Development Goals: The Gender Snapshot 2022.
- Bardsley, D. (2017). Indigenous knowledge and practice for climate change adaptation. Elsevier.
- Baum, J., & Villasenor, J. (2023, July 18). How close are we to AI that surpasses human intelligence? Brookings. <https://www.brookings.edu/articles/how-close-are-we-to-ai-that-surpasses-human-intelligence/>
- Bhorat, H., Signé, L., Asmal, Z., Monnakgotla, J., & Rooney, C. (2023). Digitalization and digital skills gaps in Africa: An empirical profile. Brookings Institution. <https://www.brookings.edu/wp-content/uploads/2023/05/Bhorat-et.-al-May-2023-Digitalization-and-digital-skills-in-Africa-2.pdf>
- Brondizio, E., Diaz, S., Settele, J., & Ngo, H. T. (Eds.). (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Zenodo. <https://doi.org/10.5281/zenodo.6417333>
- Carmichael, M., Bender, J., Chiarelli, N., Clemence, M., Ryan, P., & Ing, B. (2023). Global Trends 2023: A new world disorder. Ipsos. <https://www.ipsos.com/sites/default/files/2023-Ipsos-Global-Trends-Report.pdf>
- Cascais, A. (2022, July 16). Abortion: Is Africa becoming more liberal? Dw.Com. <https://www.dw.com/en/abortion-is-africa-becoming-more-liberal/a-62481744>
- Center for Reproductive Rights Africa Program. (2023, June 27). Center for Reproductive Rights. <https://reproductiverights.org/our-regions/africa/>
- Chabalala, H., Matsabisa, M., & Gqaleni, N. (2021). African natural medicine: Toward a health preservation theory and systematisation model for clinical application: African natural medicine and health preservation theory. *Journal of Traditional Chinese Medical Sciences*, 8, S32-S43.
- Choi, J., Dutz, M. A., & Usman, Z. (2020). The Future of Work in Africa: Harnessing the Potential of Digital Technologies for All. Agence française de développement and the World Bank. <https://openknowledge.worldbank.org/server/api/core/bitstreams/a79f053b-145c-5de5-9a96-4e87e6a35fa6/content>
- Disrupt Africa. (2022). The African Tech Startups Funding Report. Disrupt Africa. <https://disrupt-africa.com/wp-content/uploads/2023/02/The-African-Tech-Startups-Funding-Report-2022.pdf>
- Domínguez, L., & Luoma, C. (2020). Decolonising Conservation Policy: How Colonial Land and Conservation Ideologies Persist and Perpetuate Indigenous Injustices at the Expense of the Environment. *Land*, 9(3), Article 3. <https://doi.org/10.3390/land9030065>
- Edwards, J. K., Thiongó, A., Van den Bergh, R., Kizito, W., Kosgei, R. J., Sobry, A., Vandenbulcke, A., Zuniga, I., & Reid, A. J. (2014). Preventable but neglected: Rickets in an informal settlement, Nairobi, Kenya. *Public Health Action*, 4(2), 122-127. <https://doi.org/10.5588/pha.14.0009>
- Feldstein, S. (2019). How artificial intelligence is reshaping repression. *J. Democracy*, 30, 40.



BIBLIOGRAPHY

- FAO. (2021). The White/Wiphala Paper on Indigenous Peoples' food systems. Food and Agriculture Organisation (FAO). <https://doi.org/10.4060/cb4932en>
- Githaiga, J. (2022). Impacts of hydro climatic conditions on lesser flamingo, *Phoeniconaias minor*, Geoffroy populations in three Kenyan alkaline lakes. *Africa Journal of Physical Sciences*, 7, 9–29.
- Global Center on Adaptation. (2022). State and Trends in Adaptation Reports 2021 and 2022: Executive Summaries and Syntheses. Global Center on Adaptation. https://gca.org/wp-content/uploads/2023/01/GCA_State-and-Trends-in-Adaptation-2022_Fullreport.pdf?_gl=1*1ofpgdb*_ga*MTcwNDQyMzU0Ny4xNjkxMzk2NTA1*_up*MQ.
- Global Gender Gap Report 2022: Insight Report. (2022). World Economic Forum. https://www3.weforum.org/docs/WEF_GGGR_2022.pdf
- Gwagwa, A., Kraemer-Mbula, E., Rizk, N., Rutenberg, I., & de Beer, J. (2020). Artificial Intelligence (AI) Deployments in Africa: Benefits, Challenges and Policy Dimensions. *The African Journal of Information and Communication*, 26, 1–28. <https://doi.org/10.23962/10539/30361>
- Hoogendoorn, G., & Fitchett, J. M. (2018). Tourism and climate change: A review of threats and adaptation strategies for Africa. *Current Issues in Tourism*, 21(7), 742–759. <https://doi.org/10.1080/13683500.2016.1188893>
- Hountondji, P.J., (2009). Knowledge of Africa, knowledge by Africans: Two perspectives on African studies. *RCCS Annual Review. A selection from the Portuguese journal revista crítica de ciências sociais*, (1).
- ICCA Consortium. (2021). Territories of Life: 2021 Report. ICCA Consortium: worldwide. <https://report.territoriesoflife.org/wp-content/uploads/2021/09/ICCA-Territories-of-Life-2021-Report-FULL-150dpi-ENG.pdf>
- Intergovernmental Panel on Climate Change. (October 2022). Fact sheet—Africa (Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability). Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Africa.pdf
- International Indigenous Peoples' Summit on Sustainable Development. (2002). Kimberley Declaration. Kimberley, South Africa.
- Jensen, L. (Ed.). (2022). The Sustainable Development Goals Report 2022. United Nations. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>
- Kashwan, P., V. Duffy, R., Massé, F., Asiyambi, Adeniyi P., & Marijnen, E. (2021). From Racialized Neocolonial Global Conservation to an Inclusive and Regenerative Conservation. *Environment: Science and Policy for Sustainable Development*, 63(4), 4–19. <https://doi.org/10.1080/00139157.2021.1924574>
- Kiemde, S. M. A., & Kora, A. D. (2022). Towards an ethics of AI in Africa: Rule of education. *AI and Ethics*, 2(1), 35–40. <https://doi.org/10.1007/s43681-021-00106-8>
- Kioko, C., Kagumire, R., & Matandela, M. (Eds.). (2020). Challenging Patriarchy: The Role of Patriarchy in the Roll-back of Democracy. Heinrich Böll Stiftung. <https://ke.boell.org/sites/default/files/2020-05/Final%20copy-%20Challenging%20Patriarchy%20.pdf>
- Kipruto, H.K., Karamagi, H.C., Kidane, S.N., Mwai, D., Njuguna, D., Droti, B., ... & Nabyonga-Orem, J. (2023). Estimating the economic impact of COVID-19 disruption on access to sexual and reproductive health and rights in Eastern and Southern Africa. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1144150>
- Kodnani, D., & Pierdomenico, G. (2023, March 26). The Potentially Large Effects of Artificial Intelligence on Economic Growth (Briggs/Kodnani). <https://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.html>
- Krönke, M. (2020). Africa's digital divide and the promise of e-learning (Policy Paper, p. 20). Afrobarometer. https://www.afrobarometer.org/wp-content/uploads/migrated/files/publications/Policy%20papers/pp66-africas_digital_divide_and_the_promise_of_e-learning-afrobarometer_policy_paper-14june20.pdf
- Kwanya, T. (2015). Indigenous knowledge and socioeconomic development: indigenous tourism in Kenya. In *Knowledge Management in Organisations: 10th International Conference. KMO 2015, Maribor, Slovenia, August 24-28, 2015, Proceedings 10* (pp. 342-352). Springer International Publishing.
- Levers, LL. (2006). Traditional healing as indigenous knowledge: Its relevance to HIV/AIDS in southern Africa and the implications for counsellors. *Journal of Psychology in Africa*, 16 (1), 87-100.
- Maina, G. (2012). An Overview of the Situation of Women in Conflict and Post-Conflict Africa. <https://www.files.ethz.ch/isn/164655/ACCORD-conference-paper-1-2012-women-in-conflict.pdf>
- Magni, G. (2017). Indigenous knowledge and implications for the sustainable development agenda. *European Journal of Education*, 52(4), 437-447.



BIBLIOGRAPHY

- Makunya, T. M., Afoyomungu, O. L., Azanu, R. F. M., & Murden, D. (2021). Selected developments in human rights and democratisation in Africa during 2020. <https://repository.gchumanrights.org/handle/20.500.11825/2466>
- Mbeche, W. A. (2009). Community Dialogue with Design: The Case of EcoSan Toilet in Kisumu, Kenya (Doctoral dissertation).
- McKinsey. (2019). The power of parity: Advancing women's equality in Africa
- Mekonen, S. (2017). Roles of traditional ecological knowledge for biodiversity conservation. *Journal of Natural Sciences Research*, 7(15), 21-27.
- Melash, A. A., Bogale, A. A., Migbaru, A. T., Chakilu, G. G., Percze, A., Ábrahám, É. B., & Mengistu, D. K. (2023). Indigenous agricultural knowledge: A neglected human based resource for sustainable crop protection and production. *Heliyon*, 9(1).
- Moodley, L., Kuyoro, M., Holt, T., Leke, A., Madgavkar, A., Krishnan, M., & Akintayo, F. (2019). The power of parity: Advancing women's equality in Africa (p. 68). <https://www.mckinsey.com/featured-insights/gender-equality/the-power-of-parity-advancing-womens-equality-in-africa>
- Morna, C. L., Tolmay, S., & Makaya, M. (2021). Women's Political Participation: Africa Barometer 2021. International Institute for Democracy and Electoral Assistance. <https://www.idea.int/sites/default/files/publications/womens-political-participation-africa-barometer-2021.pdf>
- Mwendwa, S. K. K. (2001). Home2: The poetics and politics of housing in Kenya. University of California, Berkeley.
- Müller, C., Waha, K., Bondeau, A., & Heinke, J. (2014). Hotspots of climate change impacts in sub-Saharan Africa and implications for adaptation and development. *Global change biology*, 20(8), 2505-2517.
- Ngila, F. (2022, June 23). Africa is joining the global AI revolution. Quartz. <https://qz.com/africa/2180864/africa-does-not-want-to-be-left-behind-in-the-ai-revolution>
- Nkomo, J. C., Nyong, A. O., & Kulindwa, K. (2006). The impacts of climate change in Africa. Final draft submitted to the Stern Review on the Economics of Climate Change, 51.
- Nwoke, C., & Cochrane, L. (2022). Systematic Review of Gender and Humanitarian Situations Across Africa. *Africa Spectrum*, 57(3), 301-326. <https://doi.org/10.1177/00020397221128322>
- OECD. (2021). SIGI 2021 Regional Report for Africa. Organisation for Economic Co-operation and Development. https://www.oecd-ilibrary.org/development/sigi-2021-regional-report-for-africa_a6d95d90-en
- OECD. (2023, July 11). OECD Employment Outlook 2023: AI and jobs, an urgent need to act. OECD. <https://www.oecd.org/employment-outlook/2023>
- Ordu, A. U., & Ntungire, N. (Eds.). (2023). Foresight Africa: Top Priorities for the Continent In 2023. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2023/01/foresightafrica2023_fullreport.pdf
- Overland, I., Fossum Sagbakken, H., Isataeva, A., Kolodzinskaia, G., Simpson, N. P., Trisos, C., & Vakulchuk, R. (2022). Funding flows for climate change research on Africa: Where do they come from and where do they go? *Climate and Development*, 14(8), 705-724. <https://doi.org/10.1080/17565529.2021.1976609>
- Owusu-Ansah, F. E., & Mji, G. (2013). African indigenous knowledge and research. *African Journal of Disability*, 2(1), 1-5.
- Plantinga, P. (2022). Digital discretion and public administration in Africa: Implications for the use of artificial intelligence. *Information Development*, 02666669221117526. <https://doi.org/10.1177/02666669221117526>
- Rautela, P., & Karki, B. (2015). Weather forecasting: Traditional knowledge of the people of Uttarakhand Himalaya. *Journal of Geography, Environment and Earth Science International*, 3, 1-14.
- Rocca, C., & Schultes, I. (2020). Africa's Youth: Action Needed Now to Support the Continent's Greatest Asset. <https://mo.ibrahim.foundation/sites/default/files/2020-08/international-youth-day-research-brief.pdf>
- Rogerson, A., Hankins, E., Nettel, P. F., & Rahim, S. (2022). Government AI Readiness Index 2022. Oxford Insights. https://static1.squarespace.com/static/58b2e92c1e5b6c828058484e/t/639b495cc6b59c620c3ecde5/1671121299433/Government_AI_Readiness_2022_FV.pdf
- Sanago, G. (2022, November 19). How Indigenous Peoples in Africa are impacted by climate change—IWGIA - International Work Group for Indigenous Affairs. <https://www.iwgia.org/en/news/4959-how-indigenous-peoples-in-africa-are-impacted-by-climate-change.html>
- Sintayehu, D. W. (2018). Impact of climate change on biodiversity and associated key ecosystem services in Africa: a systematic review. *Ecosystem health and sustainability*, 4(9), 225-239.
- State of Climate in Africa highlights water stress and hazards. (2022, September 8). World Meteorological Organization. <https://public.wmo.int/en/media/press-release/state-of-climate-africa-highlights-water-stress-and-hazards>



BIBLIOGRAPHY

- Tantoh, H. B., McKay, T. T. J. M., Donkor, F. E., & Simatele, M. D. (2021). Gender Roles, Implications for Water, Land, and Food Security in a Changing Climate: A Systematic Review. *Frontiers in Sustainable Food Systems*, 5. <https://www.frontiersin.org/articles/10.3389/fsufs.2021.707835>
- Trisos, C., Totin, E., Adelekan, I., Lennard, C., Simpson, N., & New, M. (2022a). The IPCC'S Sixth Assessment Report: Impacts, adaptation options and investment areas for a climate-resilient East Africa. Climate and Development Knowledge Network and African Climate & Development Initiative. https://cdkn.org/sites/default/files/2022-09/IPCC%20Regional%20Factsheet_East%20Africa_WEB.pdf
- Trisos, C., Totin, E., Adelekan, I., Lennard, C., Simpson, N., & New, M. (2022b). The IPCC'S Sixth Assessment Report: Impacts, adaptation options and investment areas for a climate-resilient Southern Africa. Climate and Development Knowledge Network and African Climate & Development Initiative. https://cdkn.org/sites/default/files/2022-03/IPCC%20Regional%20Factsheet_Southern%20Africa_Web.pdf
- Trisos, C., Totin, E., Adelekan, I., Lennard, C., Simpson, N., & New, M. (2022c). The IPCC'S Sixth Assessment Report: Impacts, adaptation options and investment areas for a climate-resilient West Africa. Climate and Development Knowledge Network and African Climate & Development Initiative. https://cdkn.org/sites/default/files/2022-03/IPCC%20Regional%20Factsheet%202_West%20Africa_web.pdf
- UNCTAD. (2023). Technology and innovation report 2023: Opening green windows: Technological opportunities for a low-carbon world. United Nations Conference on Trade and Development (UNCTAD). https://unctad.org/system/files/official-document/tir2023_en.pdf
- UNESCO. (2017). Local Knowledge, Global Goals. UNESCO.
- UNESCO. (2019). UNESCO and gender equality in sub-Saharan Africa: Innovative programmes, visible results. UNESCO.
- United Nations. (2022). Human Development Report 2021-22. In Human Development Reports. United Nations. <https://hdr.undp.org/content/human-development-report-2021-22>
- United Nations Department of Economic and Social Affairs, Population Division. (2022). World Population Prospects 2022: Summary of Results (UN DESA/POP/2022/TR/NO. 3). https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf
- Vallance, C. (2023, March 28). AI could replace equivalent of 300 million jobs—Report. BBC News. <https://www.bbc.com/news/technology-65102150>
- Veettil, B. K., & Kamp, U. (2019). Global Disappearance of Tropical Mountain Glaciers: Observations, Causes, and Challenges. *Geosciences*, 9(5), Article 5. <https://doi.org/10.3390/geosciences9050196>
- World Health Organisation. (2019). WHO Global Report on Traditional and Contemporary Medicine 2019. World Health Organisation.
- World Meteorological Organisation. (2023). State of the Climate in Africa 2022. World Meteorological Organisation.
- World Wildlife Fund. (2019). Protecting the habitats of lesser flamingos in East Africa. World Wildlife Fund. <https://www.worldwildlife.org/magazine/issues/winter-2019/articles/protecting-the-habitats-of-lesser-flamingos-in-east-africa>



About Mawazo Institute

The Mawazo Institute is a Nairobi-based non-profit that leverages experts, citizens and decision makers to inspire the big ideas our future needs.

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