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Unveiling the Controversies: ICTs in Agriculture and the Challenges for Africa*

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Introduction

Information and Communication Technologies (ICTs) have the potential to revolutionize agriculture in Africa, offering a myriad of benefits to farmers and stakeholders across the entire agricultural value chain. Such benefits include the democratization of information, where farmers can access real-time weather forecasts, market prices, and valuable agronomic insights through mobile applications (Cravero *et al.*, 2022). ICTs empower farmers to make informed decisions about crop management, resource allocation, and market strategies. Additionally, ICTs facilitate financial inclusion by providing digital platforms for farmers to access credit, insurance, and banking services, thereby enhancing their financial resilience (Parlasca *et al.*, 2022). ICTs can contribute to the agro-food sustainability transition by optimizing resource utilization, reducing environmental impact, and contributing to sustainable agricultural practices (Bilali & Allahyari, 2018). Through connectivity and data-driven solutions, ICTs would create a more interconnected and resilient agricultural landscape in Africa, fostering increased productivity, improved livelihoods, and long-term food security (Ayim *et al.*, 2022).

While ICTs have been hailed for revolutionising global agriculture, with the Food and Agriculture Organization (FAO) predicting that the market for precision agriculture technologies will reach \$10 billion by 2025, this optimistic view often overlooks critical challenges, particularly in the Global South, and more specifically in Africa (FAO, 2021). Here, the digital divide is stark, with only around 25% of African farmers having access to the Internet, compared to over 80% in developed countries (ITU, 2020). This gap not only highlights the challenges, but also raises questions about the equitable distribution and potential of ICTs to transform agriculture in developing countries.

The African context presents a complex picture, with North African countries such as Egypt facing different ICT challenges in agriculture than those in Sub-Saharan regions such as Kenya, Tanzania or Nigeria. This disparity is attributed to different levels of infrastructure, economic development and climatic conditions. However, the impact of Internet use on agriculture has been mixed. While it has been shown to increase crop production, the same increase in Internet usage has led to a decrease in livestock production, suggesting a nuanced and potentially

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disruptive impact of ICTs on different agricultural sectors (Onyeneke *et al.*, 2023). In addition, mobile phone subscriptions, while beneficial for livestock production, have had a long-term negative impact on crop production (GSMA, 2021).

The focus on local solutions in countries such as Rwanda and Ghana, integrating local knowledge into ICT strategies, is promising. However, this is overshadowed by a diverse political landscape across the continent. While countries such as South Africa with stable governance systems have successfully implemented ICT policies, others struggling with political instability face significant hurdles. Furthermore, the socio-economic impact of ICTs in agriculture is not uniform across the continent. In West African countries where agriculture is the backbone of livelihoods, the adoption of ICTs has profound implications for job security and social dynamics that may not be consistent with the effects observed in more economically diversified regions (UNDP, 2020).

Despite the potential benefits of ICTs for agricultural development in Africa, critical issues demand attention. This work aims to unravel these crucial issues by shedding light on the controversies surrounding the utilization of ICTs in African agriculture, ultimately striving to fully realize the potential of ICT in facilitating effective agricultural practices.

Controversies Surrounding ICTs in Agriculture in Africa

While the potential for ICTs to transform agriculture in Africa is significant, their use is not without complexities and nuanced challenges specific to the continent. Africa's diverse agricultural landscape presents unique scenarios where the benefits of ICTs coexist with a spectrum of challenges. These challenges stem from a range of factors, including infrastructural constraints, varying levels of technological literacy, socio-economic disparities and the need for culturally sensitive approaches to technology adoption (Mhlanga & Ndhlovu, 2023). Thus, while ICTs promise to increase agricultural productivity and sustainability, they also raise critical issues of equitable access, job security, ethical data management and the preservation of traditional agricultural practices within the evolving technological paradigm.

1. Widening the Digital Divide

Globally, there is a pronounced digital divide. The International Telecommunication Union's (ITU) *Measuring Digital Development: ICT Price Trends 2019* report highlights that despite falling prices for telecommunication services, Internet penetration rates are not increasing rapidly. This trend is particularly evident in the Global South, where affordability does not necessarily translate into accessibility (ITU, 2020).

The gap in ICT access between urban and rural areas in developing countries is also stark. While urban areas may have better access to technology and infrastructure, rural areas, where most smallholder farmers live, often lack basic ICT services. In Sub-Saharan Africa, for instance, less than 10% of agricultural households have access to the Internet, compared to over 70% in Europe and North America. This digital divide limits the potential benefits of ICTs to a small segment of the agricultural sector, exacerbating inequalities between smallholders and large agribusinesses.

2. Cost and Affordability Challenges

The cost barrier to ICT in agriculture is significant in the Global South. The Global System for Mobile Communications Association's (GSMA) report, *The Mobile Economy Sub-Saharan Africa 2020*, shows that while mobile connectivity continues to drive digital transformation in Sub-Saharan Africa, with a penetration rate of 43% of unique mobile subscribers and 25% of mobile Internet users by 2023, the adoption of advanced technologies is still limited by cost and affordability issues. The report highlights that while 3G remains the dominant technology, 4G adoption and anticipation of 5G is concentrated in urban areas, leaving rural and agricultural communities behind (GSMA, 2021). Also, the advanced technologies like sensors, drones, and data storage systems are often beyond the financial reach of many farmers, creating a scenario where only well-funded agribusinesses can afford these innovations. Small scale farmers will not be able to pay for information services provided by such technologies (Abdulai *et al.*, 2023). The high cost of ICTs is a significant barrier for small-scale farmers in Africa.

3. Infrastructure and Accessibility Constraints

In Africa, the infrastructure needed to effectively use ICTs in agriculture is often lacking. The limited ICT infrastructure in rural and remote areas of Africa is a major hindrance to the adoption of these technologies. Issues such as lack of electricity, adequate telecommunication infrastructure, reliable and affordable Internet, and basic ICT literacy are prevalent, restricting the reach and effectiveness of technological solutions in these regions (Ayim *et al.*, 2022).

The United Nations Conference on Trade and Development's (UNCTAD) Digital Economy Report 2021 highlights the challenges of managing and harnessing the surge in digital data for global benefit. It emphasises that the COVID-19 pandemic has accelerated digital transformation, but the surge in global Internet traffic poses significant challenges for developing countries, particularly in terms of data governance and equitable distribution of the benefits of data flows. The report highlights the importance of innovative approaches to data governance to ensure a more equitable distribution of the benefits of data flows, while addressing risks and concerns (UNCTAD, 2021).

4. Governance and Policy Gaps

Policy gaps in ICT governance are evident in many African countries. In its Africa Agriculture Status Report, the Alliance for a Green Revolution in Africa (AGRA) highlights the need for a concerted response by governments, the private sector, communities and individuals to strengthen Africa's food systems. The report, entitled *Empowering Africa's Food Systems*, provides an in-depth examination of the vulnerabilities, challenges and transformative potential of the continent's food systems. It highlights the urgent need for innovative financing and the critical role of knowledge and technology in addressing these challenges (AGRA, 2019).

5. Socioeconomic Implications and Job Security

The integration of ICTs into agriculture is a transformative development with far-reaching socioeconomic implications. In many African countries, where agriculture is a major employment sector, the introduction of these technologies promises increased efficiency but also poses challenges to traditional job roles, especially in manual labour. This shift has the potential to significantly reshape rural economies and livelihoods, as detailed in studies like Salam *et al.* (2018). The impact varies across the continent; for example, in West African

countries where agriculture is the primary livelihood, the integration of ICTs might profoundly affect job security and social dynamics, in contrast to regions with more diversified economies.

In addressing the complexities of integrating new technologies, the United Nations Development Programme's (UNDP) Human Development Report 2020 highlights the critical need to consider both human and environmental factors. This perspective is crucial in developing strategies that not only foster technological advancement but also proactively manage the socio-economic transformations they bring, aiming for both equity and sustainability in development (UNDP, 2020).

6. Privacy and Security Concerns

In Africa, where data governance frameworks are often in their nascent stages, the use of ICTs in agriculture raises significant concerns about data ownership, rights, and the necessity for regulation (Wiseman *et al.*, 2019) which are linked to Sustainable Development Goal (SDG) 9 (Industry, Innovation and Infrastructure, Target 9.4, which calls for the upgrading of technological capabilities of industries to enhance economic productivity in a sustainable manner while reducing the negative environmental impact) and SDG 16 (Peace, justice and strong institution, particularly Target 16.10, which aims to ensure public access to information and protect fundamental freedoms in accordance with national legislation and international agreements).

The collection and storage of sensitive information such as farm locations, crop yields, and financial data pose risks of unauthorized access and misuse, creating a reluctance among farmers to adopt these technologies.

7. Dependence on Technology and Loss of Traditional Knowledge

There is a growing concern that reliance on ICTs may lead to the erosion of indigenous farming knowledge and practices in Africa. This dependence could make farmers vulnerable to technological disruptions and reduce their self-sufficiency, undermining long-standing agricultural traditions. There is a danger of losing indigenous knowledge and cultural practices to the introduction of smart agriculture practices (Asem-Hiablie *et al.*, 2023).

Conclusion

In conclusion, the integration of Information and Communication Technologies (ICTs) in African agriculture presents both significant opportunities and challenges. While ICTs can enhance efficiency and productivity, addressing the digital divide and structural inequalities is crucial for their effective implementation. It is imperative to incorporate local knowledge and address region-specific challenges to ensure that these technologies are accessible and beneficial to all, particularly in rural and underserved areas. Moving forward, a balanced approach that focuses on sustainable development, equitable access, and environmental stewardship, as highlighted in the UNDP Human Development Report 2020, will be key to realizing the full potential of smart agriculture in Africa and the Global South.

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