

Research Application Summary

## **Agri-Tech and Artificial Intelligence (ATAI) Opportunities for Agricultural Transformation in Africa**

Amitu, D. M., Otto, F. & Kato, J.

Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), P. O Box 16811,  
Wandegeya, Kampala, Uganda

**\*Corresponding author:** [d.amitu@ruforum.org](mailto:d.amitu@ruforum.org)

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### **Abstract**

As disruptive technologies descend upon the global agriculture industry, the entire ecosystem is shifting strategies in order to remain relevant and competitive. Agri-Tech on its part utilizes technology to improve yields, efficiency and profitability in agriculture, horticulture and aquaculture. For Artificial Intelligence it utilizes the increasing capability of machines to perform a number of tasks while mimicking cognitive functions which are associated with the human mind, for example learning and problem solving or any other tasks that require intelligence. In this article, we explore opportunities presented by Agri-Tech and Artificial Intelligence (ATAI) for agricultural transformation in Africa as well as the potential challenges for this transformation.

Key words: Agriculture, Artificial Intelligence, network, technology

### **Résumé**

Alors que les technologies disruptives s'abattent sur l'industrie agricole mondiale, l'ensemble de l'écosystème change de stratégie afin de rester pertinent et compétitif. Pour sa part, Agri-Tech utilise la technologie pour améliorer les rendements, l'efficacité et la rentabilité de l'agriculture, de l'horticulture et de l'aquaculture. Quant à l'intelligence artificielle, elle utilise la capacité croissante des machines à effectuer un certain nombre de tâches tout en imitant les fonctions cognitives associées à l'esprit humain, par exemple l'apprentissage et la résolution de problèmes ou toute autre tâche nécessitant de l'intelligence. Dans cet article, nous explorons les opportunités présentées par l'Agri-Tech et l'Intelligence Artificielle (ATAI) pour la transformation de l'agriculture en Afrique ainsi que les défis potentiels de cette transformation.

Mots clés : Agriculture, Intelligence Artificielle, réseau, technologie

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### **Introduction**

Increased access to technology by smallholder farmers is one of the disruptive ways to change the world, and Africa is making critical steps towards adopting the existing and emerging technologies in the farming processes. This is being done as the continent seeks to guarantee food security for its population, which is estimated to peak at two billion by 2050 (Cohen, 2003). With Artificial Intelligence (AI), crops can be more efficiently and cost-effectively grown by farmers for example by using hyperspectral cameras mounted on drones, changes in water and fertilizer usage can effectively be monitored, changes in crop yield detected as fast as possible, and the emergence of pests detected as early as possible. This is possible because an AI software analyzes the captured images and not only alerts farmers about the changes but also offers predictions.

In recent years, Africa has seen growth in the number of Agri-Tech services that offer things such as farmer advisory services or access to finance via smart phone. Despite this increase, an estimated market value worth over \$2.2-billion inform of digital services that could support African smallholders still remains untapped (Tsan *et al.*, 2019) and this represents more than 90% market for digital services that support African smallholders. The Technical Centre for Agricultural and Rural Co-operation (CTA) and Dalberg Advisors (Tsan *et al.*, 2019), reported that there were around four hundred (400) various digital agriculture solutions with thirty-three million (33,000,000) registered farmers across sub-Saharan Africa. These solutions involved farmer advisory services, which provided weather or planting information via Short Message Service (SMS) or via mobile applications, and financial services which included loans and insurance for farmers. Some services used satellite imagery, weather data, powerful big data analytics and machine learning techniques to deliver valuable real-time agricultural insights and forecasts at national and regional levels. The CTA report (Tsan *et al.*, 2019) highlighted more than 40% in annual growth for both the number of registered farmers and the number of digital solutions. This suggests that Agri-Tech market in Africa is likely to reach the majority of the region's farmers by the year 2030.

Africa's agricultural industry has a huge potential with ability to reach a large market as believed by most investors. According to Disrupt Africa's African Tech Start-ups Funding Report 2017 (Africa, 2017), Agri-Tech start-ups received US\$13.2 million in funding last year, the fourth largest of any sector. This was an increase of 203% from 2016. The rapid growth of Agri-Tech business in Africa is demonstrated by the increase of over 13 million in funding since just 2015, where funding was \$50,000.

**Opportunities presented by Agri-Tech and Artificial Intelligence (ATAI).** Agri-Tech and Artificial Intelligence presents a number of opportunities for Agriculture in Africa. These include;

**Efficient crop harvesting and weed control:** A number of companies are involving technology in crop harvesting and weed control for example autonomous agricultural robots are developed and programmed to harvest crops at a much higher volume and faster pace than human laborers as shown in Figure 1.



**Fig 1. Citrus Picking System**

In addition to harvesting, weed control is also a top priority for farmers because herbicide resistance has become more of a commonplace. An estimated 250 species of weeds have become resistant to herbicides (Soltani *et al.*, 2017). As a result of this herbicide resistance, farmers are now encouraged to utilize technology in form of automation and robotics to help them with more efficient ways to protect their crops from weeds as shown in Figure 2.



**Figure 2. Robot attached to a tractor to thin out lettuce fields and prevent herbicide resistant weeds**

**Crop and soil monitoring.** By leveraging on Artificial Intelligence (deep-learning algorithms in particular), data captured by drones and/or software-based technology can be efficiently processed in order to monitor crop and soil health as shown in Figure 3. The data captured by the drone is either transferred to the computer or uploaded to the cloud for analysis. The applications in the computer or cloud use algorithms to integrate and analyze the captured images and data in order to provide a detailed report on the health of the crop, specifically by reporting on the condition of the leaves of the crop. This is mainly applicable in cases where crop leaves often provide symptoms of crop diseases (such as molds and bacteria). This is mainly because reading the “health” of the leaves is often a good proxy for understanding the health of the plants and their fruits as a whole.



**Figure 3. Agrobotix drone: a low-cost crop data tool for farmers, over time, or in real-time, equipped with infrared sensors**

**Predictive analytics.** The use of Artificial Intelligence, specifically, machine learning algorithms in conjunction with satellites, can effectively and efficiently predict weather, at the same time analyze crop sustainability and evaluate farms for the presence of not only diseases but also pests. This can be done by reporting to farmers daily weather predictions, and these reports can be customized based on the needs of

each client/farmer while ranging from hyperlocal to global. These analytics have also opened opportunities for entrepreneurs in Africa who are increasingly seeing opportunities in the agricultural sector and are developing solutions that enable farmers to increase their yields and access markets not only in Africa but globally.

## Challenges

Despite the huge potential in terms of the opportunities in ATAI for agricultural transformation in Africa, a number of challenges that need to be looked into still exist for the full exploitation of this potential. For example, there are several gaps in the uptake of digitalization in agriculture, particularly among women, who account for more than 40% of the agricultural labor force yet comprise only a quarter of the registered users of digital services.

The digital divides and other concerns such as the privacy and safety of farmer data remain potential risks. There is also inadequate training for farmers in the usage of ATAI technologies and related applications. Overall, extensive testing and validation of emerging ATAI applications is very critical as agriculture is impacted by environmental factors that cannot be controlled unlike in the case of other industries where risk is easier to model and predict.

## Conclusion

Agri-Tech and Artificial Intelligence (ATAI) driven technologies are emerging to help improve efficiency and to address challenges facing the agricultural industry including crop yield, soil health and herbicide-resistance. Agricultural robots are already making a huge impact in the agricultural sector and have become a highly valued application of AI in this sector due to their ability to complete an increasing diverse array of tasks in an effective and efficient manner. Due to growing research in the area of climate change, other technologies too like Crop and soil monitoring technologies will be important applications going forward. Additionally, due to lack of skills for farmers in Information and Communication Technologies (ICT), they should be trained in the utilization of the ATAI technologies. Steady adoption of ATAI in agricultural industry is anticipated.

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