



Farmers often lack stable internet connectivity, affordable devices, or sufficient digital literacy. PHOTO/THECONVERSATION

## AI offers promise for agriculture

In recent years, the use of Artificial Intelligence (AI) tools has been shown to improve input-output efficiency and enable real-time monitoring of crops and livestock.

**G**lobally, agriculture faces mounting pressures. These are driven by climate change, land degradation, labour shortages, supply chain disruptions and the demand for food from a growing population.

At the same time, productivity is uneven. For example, maize yields in the US often exceed 9,071 kilogrammes per hectare. These high yields are driven by mechanisation, improved seed varieties, irrigation and efficient input use, supported increasingly by precision agriculture technologies. In contrast, yields in many parts of sub-Saharan Africa remain around 2-3 tons per hectare. This reflects constraints like limited access to inputs, reliance on rain-fed systems and weaker infrastructure and institutional support.

Smallholder farmers make up around 80 percent of farmers in developing countries. They often struggle with low yields due to limited access to key agricultural inputs such as improved seeds, fertilisers and agrochemicals (herbicides and pesticides). They are less likely to rely on

irrigation and farm mechanisation. They also have high vulnerability to climate shocks.

Conventional farming practices, including reliance on rain-fed agriculture, the use of low-yielding local seed varieties, sub-optimal input application and heavy dependence on manual labour, are increasingly insufficient to meet the demands of 21st Century food systems.

AI has strong potential to improve agricultural productivity and resilience. But this potential depends on supportive policies, reliable infrastructure and equitable access. Without these, the technology could reinforce existing inequalities rather than reduce them.

### The potential and the gaps

Patterns of AI adoption: including the extent of uptake across regions, and types of AI applications used in agriculture (such as precision farming, disease detection, yield prediction, and smart irrigation) Levels of infrastructural readiness: including the availability of electricity, broadband connectivity, dig-

### WAY FORWARD

AI could transform agriculture in Africa and other developing economies but without the right policies, it may deepen inequality instead. The priority is to fix the foundations. Reliable electricity, internet access, and affordable digital tools are essential. Without these, AI will remain out of reach for most smallholder farmers. Access to finance, training, and locally relevant data systems will also be critical. Adoption should be gradual, starting with simple tools like advance mobile advisory services before scaling up. AI must be inclusive and farmer centred. Done right, it can strengthen food systems. Done poorly, it risks leaving the most vulnerable further behind.

ital literacy support, data management systems, smart devices, and extension or technical support services necessary for effective AI adoption Key concerns around ethics and data governance: including data ownership, privacy and security, informed consent, algorithmic bias, transparency, accountability, and equitable ac-

cess to AI-driven agricultural technologies. AI is increasingly shaping agriculture in developed countries. Technologies such as precision farming tools are helping improve fertiliser use, irrigation, yield prediction and pest management, while also supporting more efficient resource use and greater resilience to climate variability.

### The factors that made this possible included:

**Digital infrastructure:** In many developed countries, reliable internet, satellite systems, cloud platforms and connected sensors enable continuous data collection and analysis. This supports real-time farm decisions and the seamless use of precision agriculture technologies.

**Strong institutional support:** This has enabled rapid uptake of innovations in agriculture. The support includes established governance frameworks that provide operational clarity on data privacy, transparency and accountability. This enabled more responsible technological innovation.

**Reliable electricity:** This is essential for AI-driven agriculture. It ensures the continuous operation of digital systems and technologies such as sensors, automated irrigation, drones, and data platforms.

But we found that AI adoption remains limited in developing countries, where smallholder farmers dominate food production. The limiting factors included: