



EVIDENCE EXPLAINER

The Use of Artificial Intelligence in Food and Agriculture Systems



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Key Messages



The narrative review was conducted to include relevant studies that were excluded during the rapid review due to strict criteria, such as opinion pieces and non-peer-reviewed materials. Its objective was to capture a broader range of information, particularly from key actors like developers, implementers, and funders. This approach was necessary given the emerging nature of the research area and the limited findings from the existing literature included in the rapid review.



A diverse range of stakeholders influences the digital agriculture landscape, and acknowledging the contributions of these various players is essential to understanding the broader ecosystem. The narrative review provides evidence on some of the key actors shaping this field.



There is considerable evidence addressing the surface-level challenges of equity and inclusive artificial intelligence (AI) integration. In contrast, there is a lack of comprehensive evidence on effective ways to surmount these challenges to ensure successful AI integration.



Evidence is weak on the ethics and governance of AI interventions in agriculture. While some studies highlight its importance, there is a lack of focus on existing ethics and governance frameworks in this field.

Mapping the Evidence: Existing literature on AI in agriculture



We developed a narrative review to capture the nature of existing evidence on the use of artificial intelligence (AI) in agriculture in low- and middle-income countries (L&MICs). Using the relaxed exclusion criteria, we included sources from peer-reviewed publications to non-peer-reviewed articles, grey literature (including blogs and news articles), and other relevant sources to capture a broader spectrum of perspectives. This narrative review identified 27 relevant studies that included opinion pieces, editorials, and institutional documents. Further, we conducted thematic synthesis for the included studies using the three order Qualitative Evidence Synthesis (QES) method.



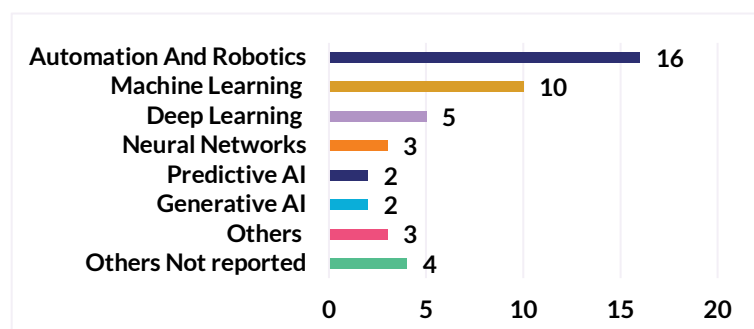
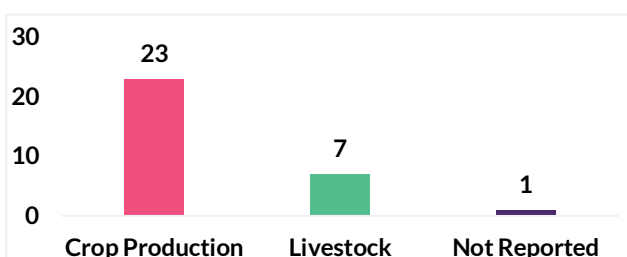
These 27 relevant studies were clustered into four overarching themes: “equity”, “inclusion and accessibility”, “role of organisations”, and “ethics and governance.” These themes were then divided into 11 sub-themes: “demographics of farmers and users”, “digital divide”, “accessibility”, “digital inclusion”, “funders”, “users”, “beneficiaries”, “implementors”, “developers”, “ethics”, and “governance”.

Mapping the Evidence: Use of AI in agriculture



The narrative review revealed that most of the existing evidence concentrates on developing and implementing initiatives within specific regions. It also discusses the sector's current state of development, future AI integration trajectories, and existing barriers.

The studies reviewed show that the integration of AI in agriculture focuses primarily on crop production, followed by livestock management. In specific target problems like forecast and prediction, detection and optimisation.



Most of the evidence demonstrated that the AI tools predominantly used in agriculture were automation and robotics, along with machine learning and deep learning. In contrast, very few studies examined interventions that

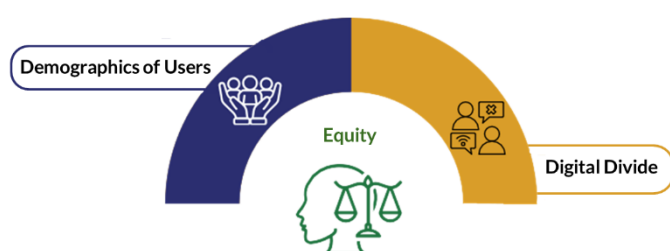
focused on tools such as neural networks, generative AI, and predictive AI.

- **Notable funding institutions include:** International Development Research Center (IDRC), World Bank, Gates Foundation, the MasterCard Foundation, UN System, the African Development Bank (AfDB), the European Union, the Foreign, Commonwealth and Development Office (FCDO), the International Fund for Agricultural Development (IFAD), and USAID
- **Notable users include:** Smallholder Farmers and farmer cooperatives.
- **Notable developer organisations include:** Water Centre for the Humid Tropics of Latin America and the Caribbean, Primebotics and the Ribeira de São Filipe Producers Association, International Maize and Wheat Improvement Center (CIMMYT), and Villgro.
- **Notable implementing organisations include:** Precision Agriculture for Development (PAD), IBM Watson Decision Platform for Agriculture, Agripoa, International Maize and Wheat Improvement Center (CIMMYT), and UNDP through Accelerator Lab.

Mapping the Evidence: Equity, Inclusion and Accessibility, and Ethics and Governance



In the narrative review, the overarching equity dimensions have been explored through the lens of user demographics and the digital divide.



In the included studies, smallholder farmers emerge as a key demographic. However, the studies do not adequately address women's participation in smallholder agriculture. Instead, women are primarily involved in informal post-harvest activities such as street vending, rather than benefiting from AI integration in agricultural production.

This raises concerns about the increased vulnerability of female farmers and the barriers they face in accessing modern agricultural tools. It emphasizes the need for special focus on rural women, training programmes, and women-centric project building to ensure that women are involved in smart agriculture.

"There is a clear gender split in the agricultural sector, with more women involved in crop production, justified by the fact that more women (47%) own arable land than men (41%). However, in most cases, it is men who have full access, ownership, and control over land and other valuable agricultural resources such as water resources, credit/finance, information, markets, technology, and agricultural support services."

The second equity sub-theme addresses the digital divide, with particular emphasis on the cultural barriers that hinder farmers from adopting modern agricultural practices. Traditional values and cultural norms are often seen as significant obstacles to embracing new technologies, thus limiting the implementation of AI practices in rural settings.

“AI creates unemployment. AI technologies such as smart machines, robots, and driverless tractors can do a huge amount of work in a short time and will replace humans.”

The theme of inclusion and accessibility is divided into two sub-themes: accessibility and digital literacy.

Accessibility stands out as a significant bottleneck in integrating AI in agriculture, especially in rural areas. This is primarily due to the challenges in reaching remote communities, which limits the engagement of smallholder farmers.



The lack of essential infrastructure in rural areas, such as reliable internet connectivity and facilities, creates further barriers for implementation. A key recommendation to address this bottleneck is the provision of region-specific advice and ensuring better engagement and understanding for farmers in these areas, along with creating farmer-centric solutions.

“The high cost of installing and maintaining smart machines and computers makes it unaffordable for smallholder farmers.”

Lack of technical knowledge or limited digital literacy emerges as the second sub-theme within the captured evidence. Low digital literacy in rural areas is a significant barrier to the large-scale integration of AI in agriculture. Improving digital literacy within the agricultural workforce is essential to ensure that AI-enabled solutions are used effectively. Given this challenge, it is important to prioritize simpler digital technologies, such as mobile applications, SMS/USSD, IVR, and basic computer use, which align better with the current digital capabilities of many farmers. This preference for simpler technologies is rooted in limited digital literacy among agricultural beneficiaries. Additionally, providing content in regional languages is beneficial as it helps improve accessibility and reach a wider audience. This ensures that more farmers can effectively engage with these technologies.

“There is no skilled manpower available for using AI technologies.”

There is a notable lack of studies discussing ethics and governance in digital agriculture. Some papers do highlight the importance of data collection and use and raise concerns about AI-related issues like privacy, bias, and security. However, there is no focus on existing ethics and governance frameworks in this area.