UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM TIMISOARA
"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH IN APPLIED LIFE SCIENCES"
05-06 November 2026



ARTIFICIAL INTELLIGENCE IN AGRICULTURE: A COMPARATIVE ANALYSIS OF SMART FARMING PRACTICES, CHALLENGES, AND OPPORTUNITIES IN ROMANIA AND KENYA

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ABSTRACT This study compares the integration of Artificial Intelligence (AI) and smart farming in Romania and Kenya. Based on a qualitative review of secondary literature and institutional information, it examines five dimensions: technological applications, infrastructure, economic accessibility, institutional support, and environmental sustainability. Romania's pathway is associated with precision farming, automation, remote sensing, and EU-supported modernization, while Kenya's opportunities centre on mobile advisory services, weather information, pest and disease identification, and decision-support tools for smallholders. Both contexts face constraints involving affordability, connectivity, digital skills, and access to reliable data. The analysis indicates that AI adoption must be locally adapted and supported by investment, training, enabling policies, and international cooperation to strengthen resource efficiency, climate resilience, and food security.

1. INTRODUCTION

Agriculture supports food security, rural development, employment, and environmental sustainability. AI technologies—including machine learning, predictive analytics, computer vision, remote sensing, and decision-support systems—enable more data-driven crop and resource management.

Study objective: to compare AI applications, opportunities, and barriers in Romania and Kenya, and to identify implications for sustainable agricultural development.

2. MATERIALS AND METHODS

Research design: comparative qualitative analysis based on secondary data and a structured review of relevant literature.

Five analytical dimensions: AI applications; digital and agricultural infrastructure; economic accessibility; institutional and policy support; environmental sustainability.

Information base: scientific publications, institutional reports, agricultural development studies, and publicly available information from organizations such as the European Commission, FAO, and the World Bank.

Scope limitation: the study is descriptive and interpretative; it includes no primary field measurements, direct farmer surveys, or controlled experiments.

RESEARCH WORKFLOW

1. **Review** — Scientific literature and institutional sources
2. **Framework** — Five dimensions used for comparison
3. **Compare** — Romania and Kenya: uses, enablers, barriers
4. **Synthesize** — Development priorities and implications

HOW AI CAN SUPPORT AGRICULTURAL DECISIONS

DATA	AI ANALYSIS	DECISIONS	OUTCOMES
Satellite / UAV imagery, weather, sensors, and farm records	Machine learning, computer vision, predictive analytics	Crop monitoring, pest detection, irrigation, yield forecasts	Resource efficiency, climate resilience, food security

3. RESULTS AND DISCUSSIONS

The comparison identifies different adoption pathways. Romania has greater scope for machinery-integrated precision farming and advanced monitoring; Kenya's strongest opportunities are accessible, mobile-based digital services tailored to smallholder needs.

ROMANIA



Illustrative visual

Pathway: precision agriculture
- Automated machinery and GIS
- Satellite / remote crop monitoring
- Predictive models and input optimization

KENYA



Illustrative visual

Pathway: mobile-first services
- Advisory and weather information
- Pest / disease identification
- Decision support for smallholders

TABLE 1. COMPARATIVE OVERVIEW OF KEY DIMENSIONS

Dimension	Romania	Kenya
Agricultural structure	Commercial farms and smaller holdings	Predominance of smallholder farming
Main AI opportunities	Precision farming, automation, crop monitoring	Mobile advisory, weather services, pest detection
Infrastructure and access	EU digital initiatives; uneven access and skills	Expanding mobile services; rural connectivity and electricity constraints
Economic / institutional factors	EU funding opportunities; high investment and maintenance costs	Limited capital; role for cooperative services and extension support
Environmental priorities	Drought management, water efficiency, soil conservation	Rainfall variability, drought preparedness, food security

CLIMATE RESILIENCE AND DEVELOPMENT IMPLICATIONS

In Romania, AI can support drought adaptation, soil-moisture monitoring, irrigation scheduling, and more efficient input use. In Kenya, weather forecasting, early-warning systems, and mobile advisory services can help farmers respond to rainfall variability and climate risks.

Shared requirement: reliable data, affordable access, digital skills, and institutional support are necessary for environmental benefits to materialize.

4. CONCLUSIONS

AI offers meaningful potential to improve agricultural productivity, resource efficiency, climate resilience, and food security in both countries, but there is no single adoption model. Romania can advance precision agriculture and automation, while Kenya can benefit from affordable, scalable, locally adapted mobile solutions.

Successful digitalization depends on infrastructure, finance, digital competencies, reliable information, and supportive institutions. Romanian–Kenyan cooperation, research partnerships, and knowledge exchange can accelerate inclusive innovation. Future research should test specific technologies through empirical studies, farmer surveys, and quantitative impact assessments.







