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



ARTIFICIAL INTELLIGENCE AND MODERN TECHNOLOGIES IN SMART AGRICULTURE: A COMPARATIVE STUDY OF DIGITAL TRANSFORMATION, PRECISION FARMING, AND SUSTAINABLE AGRICULTURAL DEVELOPMENT IN TAJIKISTAN AND ROMANIA

Jamoliddin JURAKHONOV[1], Alisher KAMOLZODA[1], Rauf JURAKHON[1],
Laura ȘMULEAC[2], Raul PAȘCALĂU[2]
[1]*TajikTechincal University named after Academician M.S.Osimi*
[2]*University of Life Sciences " King Mihai I" from Timișoara*

Introduction

Artificial Intelligence and modern digital technologies are transforming agriculture by improving productivity, resource efficiency, and environmental sustainability. Precision farming, IoT sensors, remote sensing, and agricultural drones offer new opportunities for crop monitoring and data-driven decision-making. Despite differences in technological development, Tajikistan and Romania share the need to modernize agricultural practices, strengthen climate resilience, and promote sustainable farming through innovation. The adoption of Artificial Intelligence and digital farming solutions can support more efficient resource management, reduce environmental impacts, and improve agricultural productivity in both countries.

Material and method

The study employs a qualitative and comparative approach based on scientific literature, agricultural development reports, and policy documents from Tajikistan and Romania. The analysis focuses on six key dimensions: agricultural digitalization, Artificial Intelligence applications, precision farming technologies, digital infrastructure, technological accessibility, and institutional cooperation. A comparative thematic matrix was used to identify technological opportunities, implementation barriers, and sustainable agricultural development priorities in both countries. The analysis examines the potential of AI, IoT sensors, robotics, and remote sensing to improve agricultural efficiency, considering technological accessibility, investment costs, and infrastructure requirements.

Result and discussions

The comparative analysis highlights significant opportunities for integrating Artificial Intelligence, precision farming, and digital technologies into agricultural systems in Tajikistan and Romania. AI-based decision support, IoT sensors, remote sensing, and agricultural drones can improve crop monitoring, irrigation management, and resource efficiency. While Tajikistan faces challenges related to infrastructure and technological accessibility, Romania benefits from European agricultural modernization programmes. Both countries require investment, farmer training, and institutional cooperation to support sustainable digital transformation.

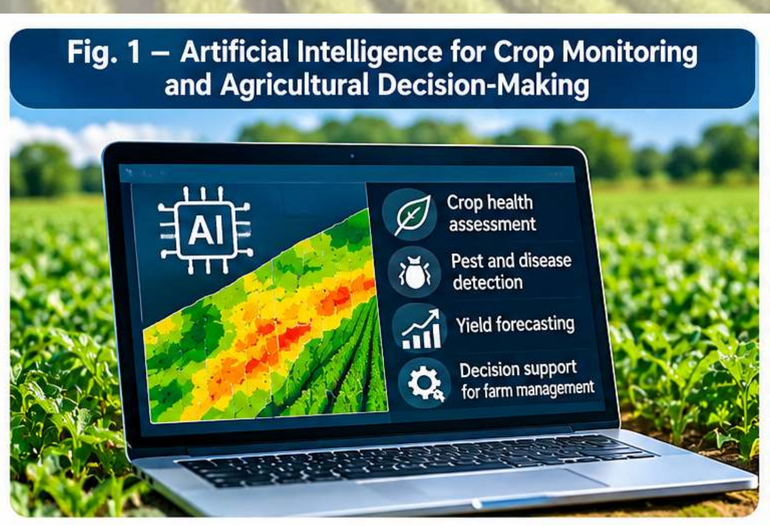

Fig. 1 – Artificial Intelligence for Crop Monitoring and Agricultural Decision-Making

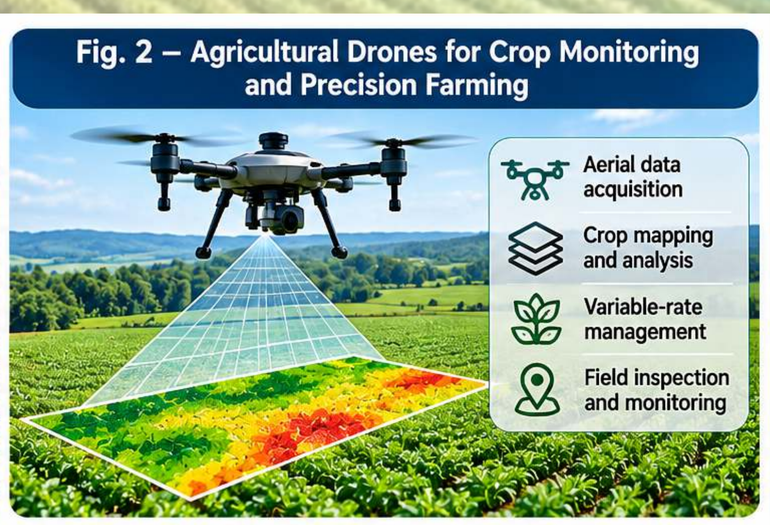

Fig. 2 – Agricultural Drones for Crop Monitoring and Precision Farming

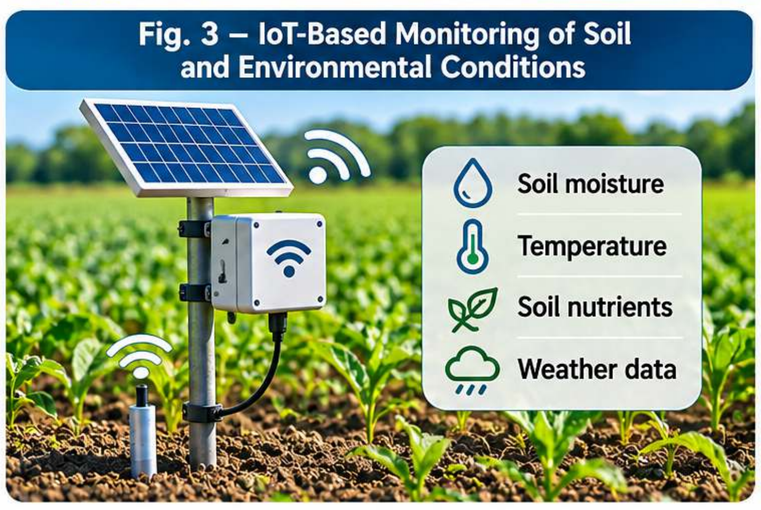

Fig. 3 – IoT-Based Monitoring of Soil and Environmental Conditions

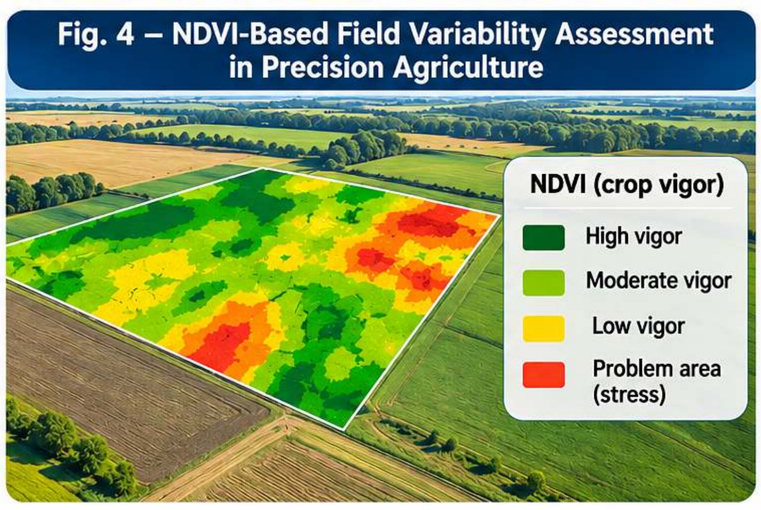

Fig. 4 – NDVI-Based Field Variability Assessment in Precision Agriculture

Artificial Intelligence supports crop monitoring, pest detection, and yield prediction, improving agricultural decision-making (Fig. 1).

Agricultural drones and remote sensing enable accurate crop assessment and precision farming applications (Fig. 2).

IoT sensors facilitate real-time monitoring of soil moisture, temperature, and environmental conditions (Fig. 3).

NDVI-based mapping identifies crop variability and supports targeted agricultural interventions (Fig. 4).

The comparative analysis reveals different priorities for agricultural digitalization in Tajikistan and Romania, influenced by technological accessibility, infrastructure, and investment capacity. Both countries can benefit from integrating AI, precision farming, and digital monitoring systems to improve resource efficiency and agricultural sustainability. Scientific cooperation and farmer training are essential for supporting the successful adoption of these technologies.

Conclusions

The study highlights the potential of Artificial Intelligence and digital technologies to improve agricultural productivity and sustainability in Tajikistan and Romania. Precision farming, IoT sensors, and remote sensing support efficient resource management and crop monitoring. Successful implementation requires adequate infrastructure, investment, and farmer training. Scientific cooperation and technological innovation are essential for advancing smart agriculture and climate resilience in both countries. The integration of AI-based solutions and precision farming technologies can reduce environmental impacts and support more efficient, sustainable agricultural practices.

Acknowledgement: This research work was carried out with the support of GEOMATICS RESEARCH LABORATORY infrastructure, https://erris.gov.ro/LABORATOR- CERCETARE GEOMATICA, BIORESOURCES, ENVIRONMENT AND GEOSPATIAL DATA CENTER from BUASMV "King Michael I of Romania" Timisoara - Faculty of Agriculture. BIORESOURCES