

HOW FARMERS IN KENYA CAN USE ARTIFICIAL INTELLIGENCE (AI) FOR AGRICULTURAL PRODUCTIVITY

BY

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Abstract

Artificial Intelligence (AI) has improved agricultural productivity and food security in Kenya by increasing crop yields and reducing risks through technologies like precision farming and predictive analytics. The purpose of this study was to evaluate artificial intelligence's potential to improve agricultural productivity and food security in Kenya. The study was guided by one objective: to investigate how farmers in Kenya can use Artificial Intelligence (AI) for agricultural productivity. Smallholder farmers in Kenya can use AI to increase food security systems can be strengthened and agricultural productivity increased through the use of artificial intelligence technologies. The study is anchored on Technology Acceptance Model. In order to improve agricultural productivity and food security in Kenya, the study will employ a desktop research design and rely on a systematic review and analysis of existing literature, policy documents, technical reports, and secondary datasets. The target population included in all publicly available documents, academic articles, government policies, reports from non-governmental organizations, and digital datasets on AI-driven agricultural innovations in Kenya published between 2015 and 2025. Based on relevance, credibility, and alignment with the study theme, a sample size of roughly 60–120 documents and 5–15 pertinent datasets was purposefully chosen. Structured searches in scholarly databases, the retrieval of gray literature from institutional repositories, the examination of national agricultural strategies, and the extraction of secondary agricultural and climate data from open-access portals are some of the data collection techniques. Key variables were extracted using a data extraction matrix after collected materials have been screened using predetermined inclusion and exclusion criteria. In order to identify emerging AI applications, opportunities, challenges, and their implications for agricultural productivity and food security, data analysis included descriptive synthesis, thematic content analysis of documents, and comparative analysis across sources.

Key words: Artificial Intelligence, Food Security, Precision Agriculture, Digital Innovation

Introduction

AI is rapidly improving, and farmers' experience plays a more important role in AI models. Our machines are already adept at detecting illnesses, interpreting languages, and assisting clients. In farming, AI may assist with data collection and analysis, task completion, and even hard labor. This allows farmers to focus more on creativity and leadership. Collaboration between humans and artificial intelligence is critical in agriculture because it allows farmers to operate more quickly, flexibly, and effectively. Companies must reconsider their business practices in order for this partnership to succeed. They must teach people to work closely with AI.

AI technology is transforming the way we identify

pests and illnesses in crops. It allows farmers to swiftly identify agricultural concerns. Mold, decay, and dangerous insects are among the challenges. This early alert helps farmers keep their crops from becoming ill. AI is having a significant impact on pest management. Did you know that pests and illnesses destroy between 20-40% of the world's crops? However, AI has excelled at dealing with this. For example, it is quite effective at detecting illnesses such as apple black rot. It can even identify which insects are inflicting the harm with greater than 90% accuracy. One sort of AI technology, known as CNNs, demonstrated remarkable accuracy, even exceeding 92%, in detecting plant problems.

Computer vision is also quite good at predicting crop

size. Artificial intelligence can generate predictions based on prior data and current situations. This is quite valuable for determining when to pick and ship out crops. It also warns about concerns such as insufficient nutrition or being too dry, preventing significant losses.

Computer vision is transforming how farmers monitor their land. They can examine massive volumes of data using artificial intelligence. This allows them to make better decisions to improve crop health and anticipate harvests. They can even identify issues before they get too large. One important task for computer vision is to monitor nutrient levels in crops. AI can determine what nutrients plants and soil require by analyzing images of them. This allows farmers to ensure that their crops receive the proper quantity of nourishment to develop robustly.

Statement of the Problem

The world is changing rapidly, particularly for farmers. With an estimated 10 billion people to feed by 2050, we require more food. However, only 12% of the globe can be cultivated. Our present food production also hurts the environment, as farming emits a lot of pollutants and consumes the majority of our fresh water. To produce more food responsibly, we must look to innovative technologies such as artificial intelligence. In today's rapidly evolving agriculture, data is crucial for farmers seeking to enhance their operations. Farmers can now collect and evaluate large amounts of data more quickly thanks to artificial intelligence (AI). This enables them to make smarter decisions that increase efficiency, conserve resources, and generate more revenue.

Studies have revealed that farmers in Kenya are increasing agricultural productivity by utilizing AI-powered solutions for real-time insect detection, individualized soil management, and predictive weather analytics. Apps such as Plant Village Nuru for disease detection, UjuziKilimo's SoilPal for soil data, and WhatsApp-based consultants that raise yields have been reported by some farmers to be up to 40% more productive. Precision agriculture combines AI, technology, and data to help farmers cultivate more efficiently. Farmers receive real-time information about their crops' demands. This entails making better use of water, fertilizer, and insecticides. It conserves water and encourages sustainable farming.

Apps like PlantVillageNuru employ computer vision to scan crop images in real time, identifying pests (e.g., fall armyworm) and diseases and making quick treatment suggestions. Additionally, devices such as UjuziKilimo's Soil Pal provide precise, real-time data on soil nutrient levels, moisture, and pH, allowing farmers to apply only the necessary fertilizer. Most instruments are also available via cell phones or SMS/USSD, making them perfect for small-scale farmers. Early adopters reported much higher productivity, with some claiming yield increases of more than 40%. Key hurdles include the high costs of some IoT devices, as well as the need for better digital literacy.

Farmers have greater issues than just producing more food. As people leave farmland for cities, farms become understaffed leading to reduction in food production. Due to unusual weather and higher temperatures are destroying certain crops altering food security. Farming too much and too hard has reduced the land's ability to produce sufficient food due to poor soils. As Jeff Rowe (2026), suggests. These difficulties must be analysed. To address these difficulties and keep farming continuing, we need to employ modern technology such as AI. Artificial intelligence has the potential to transform the farming industry. It can help farmers consume less and produce more. The market for artificial intelligence in agriculture is rapidly expanding, demonstrating its rising importance.

Theoretical Framework

This study was anchored on the Technology Acceptance Model (TAM). In Kenya, the Technology Acceptance Model is a primary framework that is used by researchers and policy makers to predict how farmers and agribusinesses will adopt innovations to boost food production and security. The model centers on two "perceived" factors that determine whether a technology like climate-resilient seeds or mobile-based tools is actually used. The belief that a tool will improve agricultural productivity in Kenya, technologies like Zai pit farming which refers to farming using small planting pits that harvest water. This type of farming has seen high adoption because according to recent studies, 97.9 of users perceive them as vital for increasing yields and reducing crop failure. This confirms the belief that a tool is easy to

operate studies of Kenyan food processors show that 77.8% of users value ease of use though they prioritize usefulness and intention of the technology more highly when deciding to adopt new systems.

Previous research has indicated a strong positive link between technology adoption and the four pillars of food security in Kenya which are availability, accessibility, stability and safety. Digital technologies and precision farming have shown boosted yields significantly. For example wheat production in some regions increased from 2.0t/ha to 4t/ha following technological interventions. Mobile phones allow farmers to bypass brokers, providing direct access to prevailing market prices and increasing transparency. Technology in the agricultural value chain improves traceability, reducing the risk of contaminated food reaching consumers.

Despite the benefits of this model, several factors can prevent a “useful” technology from being accepted in Kenya. This because many small holder farmers lack the credit required purchasing new inputs. High rates of illiteracy or poor digital skills can lead to a low “Perceived Ease of Use” for mobile applications. Limited internet connectivity and poor digital infrastructure in rural areas remain major hurdles.

Literature Review

This research study has been guided primarily by how farmers in Kenya can use Artificial Intelligence to improve agriculture, or better yet, increase the yields in their farms. According to Brian Murimi (2025). Farmers can utilize AI to enhance their yields, boost their profits, and reduce expenses. With the enormous task of feeding everyone, emerging technology such as AI offers a promising method to treat the world better while still providing enough food for everyone.

Studies demonstrate AI’s effectiveness in pest detection and yield optimization. Applications such as PlantVillageNuru show improved diagnosis accuracy and reduced pesticide misuse. This research study has been guided primarily by how farmers in Kenya can use Artificial Intelligence to improve agriculture, or better yet, increase the yields in their farms. According to Brian Murimi (2025). Farmers can utilize AI to enhance their yields, boost their profits, and reduce expenses. With the enormous task of feeding everyone, emerging technology such as AI offers a promising method to treat the world better while still providing

enough food for everyone.

As Michael Abramov (July 8, 2024), suggests, AI has altered how farmers collect and use data. They may now employ sensors, drones, and satellites to monitor their crops and fields in real time. AI technology converts this data into meaningful information, assisting farmers in making decisions such as whether to use pesticides or grow more. For example, using images, AI can detect when crops are becoming stressed. This enables farmers to determine what the soil requires. Then they may apply the appropriate amount of pesticide or fertilizer. The usage of AI in farming is only going to increase. By 2027, the globe is estimated to invest more than \$17 billion in smart agricultural technology, including AI.

Michael Abramov (July 8, 2024), goes further to highlight key analytics that are involved in the use of Artificial Intelligence. Predictive analytics is another important aspect of AI-powered farming. This entails using historical data and current information to forecast the future. These clever algorithms assist farmers by analyzing soil health, monitoring the weather, and recommending how much pesticide or fertilizer to apply. They can also assist in forecasting which crops will be in great demand and at what costs. This allows farmers to better predict seasons.

Farm management software, backed by AI, is becoming increasingly vital. This program provides farmers with a comprehensive view of their land. It assists them at every stage of the process, from determining when to plant to maximizing resource use. This program assists farmers in producing better harvests with less effort by detecting issues early on and smoothing out their workflow. This is clearly illustrated in the table below.

TECHNOLOGY	APPLICATION	BENEFITS
Predictive analytics	Soil health assessment, weather monitoring, and price forecasting.	Proactive decision-making, yield optimization, and risk reduction.
Farm Management Software	Comprehensive operational oversight and resource	Streamlined procedures, better production,

	allocation.	and improved profitability.
Computer Vision	Detecting crop stress and identifying soil deficiencies.	Early problem detection, tailored pesticide and fertilizer application.

From “*The Human-Machine Partnership: How Farmers and AI Can Work Together for Success,*” by Jeff Rowe

Recent studies show that the world's population is increasing rapidly. By 2050, we will require 60% more food. Using AI to improve agricultural decisions is a promising way to satisfy this demand in the long run. It will help farmers perform better and produce more food while minimizing environmental impact. Farmers may use AI and data to not just better their own fields, but also help feed the globe. As farming evolves, those who use data and AI effectively will be prepared for whatever comes next, (Jeff Rowe, 2026). Farmers used AI to reduce herbicide use by 90%, enhance crops, and save money. It's all about efficiency and intelligent farming. Precision agriculture combines AI, technology, and data to help farmers cultivate more food efficiently. Farmers receive real-time information about their crops' demands. This entails making better use of water, fertilizer, and insecticides. It conserves water and encourages sustainable farming.

Traditional Agriculture	Precision Agriculture with AI
Lower yields and decreased quality.	Enhanced yields and harvest quality.
Increased resource consumption.	Reduced utilization of resources and reduced waste as well.
Limited data for decision-making.	Data-driven insights for efficient resource allocation.
Uniform application of resources.	Targeted application based on real-time data

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Several desk top studies have shown that vertical farming using AI reduces water consumption and saves resources. AI-controlled greenhouses optimize temperature, humidity, and lighting for the greatest

crops. This allows farmers to utilize fewer resources while producing higher yields. AI can also detect leaks in irrigation systems, which helps to conserve water and keep crops safe. It detects issues early on, allowing farmers to address them before they become too severe. This not only conserves water but also preserves crops. Farming is evolving with AI, making it more efficient and environmentally beneficial. Farmers may use precision agriculture, vertical farming, and AI optimization to do more with less, (Michael Abramov, 2024). This innovative style of farming benefits both farmers and the environment, making the food chain more sustainable.

The utilization of this high-tech agricultural equipment is becoming increasingly widespread. The market for AI in agriculture is predicted to grow from \$1.7 billion in 2023 to \$4.7 billion in 2028. It's happening because farmers want to work more efficiently and sustainably. They also require assistance because there aren't enough personnel. Last year, over 70% of farmers farming special crops expressed an interest in adopting more automation. Each of these farms spent \$450,000 to \$500,000 per year on this technology, (Michael Abramov, 2024). The future of farming mixes AI-driven automation with human expertise. These inventions will become increasingly important as the shortage of farm labor worsens. They assist farmers in meeting the growing demand for food and remaining competitive. Farming firms benefit greatly from adopting new technology and upgrading their expertise. They can address the workforce shortage. And they get to operate their farms in a way that is both environmentally friendly and financially beneficial.

AI is improving agricultural irrigation efficiency. This method enables farmers to save water while growing their crops optimally. According to studies, AI can help farmers use 20 to 60% less water, with the top systems reducing water consumption by more than 40%. The globe needs to improve its water management. According to some forecasts, by 2030, we may have 40% less freshwater than we do now. The majority of farms across the world are tiny and located in areas with limited water resources. As a result, the use of AI in farming is critical to agriculture's future.

There are now technologies in place that control crop growth on their own. They employ sensors and clever

algorithms to monitor the weather and soil and provide plants with the appropriate amount of water. This saves water and keeps our planet cleaner by using fewer toxic chemicals. AI-powered greenhouses can also independently manage their conditions (Brian Murimi, 2025). They change the temperature, humidity, and lighting for the plants according to their requirements. This helps the plants develop while conserving energy and water.

AI-Driven Technology	Irrigation	Water Savings Potential
AI-optimized systems (Overall)	irrigation	20% to 60% compared to traditional procedures.
Precision Irrigation Controllers		Over 40%
Low-Pressure Emitters	Drip	More than 50% decrease in pumping energy

From *“The Human-Machine Partnership: How Farmers and AI Can Work Together for Success,”* by Jeff Rowe

The farming industry is plagued by a severe labor shortage, (Brian Murimi, 2025). The job is demanding, and most farmers are elderly. Farmers in the United States are on average 60 years old. Today, young people prefer simpler, higher-paying employment than farming. This issue has prompted increased usage of technology in farming. Artificial intelligence (AI) and robotics are becoming more advanced. They assist farms in continuing to operate, although fewer people are working on them.

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vertical farming, and AI optimization to do more with less, (Michael Abramov, 2024). This innovative style of farming benefits both farmers and the environment, making the food chain more sustainable.

AI-powered devices provide promise for the shortage of jobs. They can perform a variety of duties on the farm, including driving tractors on their own. There are additional systems for watering and fertilizing plants, drones for agricultural inspection, machines for spraying fields, and robots for picking vegetables in greenhouses. These technologies improve the efficiency and precision of farm operations compared to utilizing only humans. They reduce the amount of physical labor required. They also help to improve resource use and save expenditures.

The utilization of this high-tech agricultural equipment is becoming increasingly widespread. The market for AI in agriculture is predicted to grow from \$1.7 billion in 2023 to \$4.7 billion in 2028. It's happening because farmers want to work more efficiently and sustainably. They also require assistance because there aren't enough personnel. Last year, over 70% of farmers farming special crops expressed an interest in adopting more automation. Each of these farms spent \$450,000 to \$500,000 per year on this technology, (Michael Abramov, 2024). The future of farming mixes AI-driven automation with human expertise. These inventions will become increasingly important as the shortage of farm labor worsens. They assist farmers in meeting the growing demand for food and remaining competitive. Farming firms benefit greatly from adopting new technology and upgrading their expertise. They can address the workforce shortage. And they get to operate their farms in a way that is both environmentally friendly and financially beneficial.

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AI is also effective at detecting leaks in farms. These sophisticated technologies detect unusual water consumption and alert farmers about leaks. They assist in conserving water and safeguarding the crops. In areas where water is scarce, these instruments are extremely beneficial to farmers. Finally, AI pushes us to use recycled water and rainwater. This is beneficial for increasing food production, conserving water, and protecting the environment. As farming progresses, integrating AI for irrigation is critical to a sustainable future.

Computer vision is transforming how farmers monitor their land. They can examine massive volumes of data using artificial intelligence. This allows them to make better decisions to improve crop health and anticipate harvests. They can even identify issues before they get too large. One important task for computer vision is to monitor nutrient levels in crops. AI can determine what nutrients plants and soil require by analyzing images of them. This allows farmers to ensure that their crops receive the proper quantity of nourishment to develop robustly.

Computer vision does more than only check nutrition.

It also monitors for symptoms of stress, sickness, and germs. AI, unlike humans, notices little differences in the appearance of crops. For example, a machine at Shanxi University can detect problems in cauliflower almost completely. This technology enables farmers to act quickly to safeguard their crops and profit.

Computer vision is also quite good at predicting crop size. Artificial intelligence can generate predictions based on prior data and current situations. This is quite valuable for determining when to pick and ship out crops. It also warns about concerns such as insufficient nutrition or being too dry, preventing significant losses.

AI technology is transforming the way we identify pests and illnesses in crops. It allows farmers to swiftly identify agricultural concerns. Mold, decay, and dangerous insects are among the challenges. This early alert helps farmers keep their crops from becoming ill. AI is having a significant impact on pest management. Did you know that pests and illnesses destroy between 20-40% of the world's crops? However, AI has excelled at dealing with this. For example, it is quite effective at detecting illnesses such as apple black rot. It can even identify which insects are inflicting the harm with greater than 90% accuracy. One sort of AI technology, known as CNNs, demonstrated remarkable accuracy, even exceeding 92%, in detecting plant problems.

Methodology

This study adopted a secondary review research design, analyzing peer-reviewed articles, institutional reports, and datasets. This design is also known as desk review or secondary data analysis design which is a methodology which relies on the systematic collection and analysis of existing data directly from respondents. This design involves reviewing existing empirical studies, policy frameworks, technical reports and case studies published between 2020 and 2026. The review initially targeted 188 academic articles from major scholarly databases but after a careful review, the list was filtered down to 44 articles for full analysis forming the target and sample size respectively.

Data in this study was purposefully sampled and by methodically choosing pertinent peer reviewed journal and articles, the inclusion criteria being publication date between 2025 to 2025. The key themes were

extracted and organized and then analyzed thematically based on the research objective.

Findings from the Research

This study reviewed previous literature between 2020 – 2025, which indicates that AI offers substantial opportunities for enhancing sustainable agriculture and food security in Kenya. Evidence shows that AI technologies such as remote sensing and machine learning analytics have strengthened environmental monitoring systems across key sectors including agriculture. AI adoption correlates with increased yields and improved pest control efficiency among farmers. AI has improved realtime data analysis, early warning mechanisms and adaptive planning.

The study further revealed that AI is rapidly improving, and farmers' experiences play a more significant role in AI models. Our machines are already adept at detecting illnesses, interpreting languages, and assisting clients. According to (Michael Abramov, 2024) in farming, AI may assist with data collection and analysis, task completion, and even hard labor. This allows farmers to focus more on creativity and leadership. Collaboration between humans and artificial intelligence is critical in agriculture because it allows farmers to operate more quickly, flexibly, and effectively. Companies must reconsider their business practices in order for this partnership to succeed. They must teach people to work closely with AI. This research report from (Michael Abramov, 2024), (Brian Murimi, 2025), and (Jeff Rowe, 2026), shows how critical Artificial Intelligence is in the collection of data and analysis, all in the goal of productivity and food sustenance.

The study found the integration of AI into participatory agriculture and food production is emerging as a promising strategy for promoting sustainable food security in developing countries like Kenya. The study results show that the current data management system for executing community roles in food production is inefficient, time consuming and susceptible to errors. However, with AI utilization, there is potential to enhance efficiency. This finding is true in line with a study done by Chisika & Yeom (2024), on improving the role of communities in participatory food production through AI in Kenya.

According to a study done by Jeff Rowe (2026), the findings were that there still a number of challenges

being faced by smallholder farmers in the agricultural industry in Kenya. There are challenges of understaffing in the farms as people leave farmland for cities. Unusual weather patterns and higher temperatures are destroying certain crops. Farming too much and too hard has led to poor soils thus reducing the land's ability to produce more food.

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Discussions on the findings

Kenya is currently shifting towards bio-technology and science-driven innovation to combat persistent food insecurity. Climate resilient crops have been introduced to farmers to manage arid conditions. Precision farming and big data are now helping farmers to optimize soil and water use. Adoption of hermetic storage to minimize post-harvest losses has helped farmers to avoid selling their produce in a hurry and instead has given them bargaining power over brokers and middlemen who usually exploit them. Digi-farm app by Safaricom is an example of TAM in optimizing Perceived Ease of Use (PEU) by leveraging existing infrastructure. Instead of complex apps, TAM uses USSD codes (*944#) and an integrated M-pesa wallet. This mirrors the familiarity of mobile money, making the barrier to entry extremely low for rural farmers. By offering “onestop” access to oil testing digital extension services and insurance, farmers see immediate value in yield improvement and financial security outcome. Over 1 million registered farmers and nearly 90% repayment rates on digital input loans.

Conclusion

The conclusion from the findings of this research is that AI is here to revolutionize farming practices, and it can be harnessed for good. Farmers may begin to evaluate AI's performance and use it wisely. The greatest substantial performance increases in agriculture are realized when human beings and artificial intelligence collaborate. Artificial intelligence may help farmers with data collection, analysis, regular activities, and physical labor. Farmers are critical in training AI bots, evaluating their results, and guaranteeing safe AI use. Companies must reinvent business processes and train personnel to properly collaborate with AI. The human-machine relationship in farming is critical for solving the difficulties of an increasing global population and rising food demand.

AI has significant potential to enhance food security and productivity in Kenya. AI is rapidly improving, and farmers' experience plays a more important role in AI models. Our machines are already adept at detecting illnesses, interpreting languages, and assisting clients. In farming, AI may assist with data collection and analysis, task completion, and even hard labor. This allows farmers to focus more on creativity and leadership. Collaboration between humans and artificial intelligence is critical in agriculture because it allows farmers to operate more quickly, flexibly, and effectively. Companies must reconsider their business practices in order for this partnership to succeed. They must teach people to work closely with AI.

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Artificial intelligence is transforming the way farming works, and it holds a lot of potential. It fosters a close link between humans and artificial intelligence, hence

improving farming. Farmers may employ AI to use smart data, automation, and accurate approaches. This allows them to grow more, spend less, and farm in ways that benefit the environment. AI has already made a significant impact, with its adoption increasing by 25% in the previous five years. It enhanced our decision-making by 30%. The future of farming is all about collaboration - people giving their expertise and AI managing the massive data.

People and artificial intelligence (AI) can overcome many obstacles in farming. They can operate farms more efficiently and help feed the world's rising population despite adverse weather conditions. According to (Jeff Rowe, 2026), we have already seen excellent economic effects, with improved crops increasing farm revenue by 30%. This has improved the lives of farmers and increased access to food. AI technology is improving all the time. As it expands, so will its importance in farming. The future of farming depends in collaborative efforts between humans and artificial intelligence.

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