Role of Science and Technology in Poverty Alleviation Through Smart Agriculture Process in Nigeria

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Abstract

A smart Agriculture, is also known as precision agriculture which is rapidly growing field that involves the integration of technology and data analysis to optimize agriculture practice and increase efficiency in crop production in Nigeria to control the food shortage and scarcity. The smart agricultural it involves the use of sensor, drone satellite imagery and other technologies to monitor crops growth, soil condition, and weather partner. this information can be used to optimized irrigation, fertilization and pest control practice, ultimately leading to higher crop yield and reduce the waste of resource, more also smart agriculture involves the use of data analytic to analyze the collected data and identify pattern and correlations. This information can be used to informed decision about the planting, harvesting and storage. Automation is another key feature of smart agriculture, as it allows for more efficient and cost-effective farming practice, such as automated irrigation system and robotic harvesting equipment. Looking Nigeria in food shortage there are so many benefit of smart agricultural practice in a numerous way which include, increase efficiency, reduce waste and improve sustainability, it can also help to reduce the environmental impact of agriculture by reducing the use of pesticide and fertilizer, as well as reducing greenhouse gas emission through more efficiency farming practice. So in a nutshell smart agriculture present a high significant opportunity to improve the sustainability and productivity of agriculture. It can help farmers to make more inform decisions, reduce waste, and increase efficiency ultimately leading to a more sustainability and profitable agriculture sector and boost the economy growth of Nigeria.

Keywords: Smart Technology, automated irrigation, and data analysis.

INTRODUCTION

Smart agriculture, is the kind of agriculture which is involved the technology to improve agriculture practices, such as crop quality, productivity, and efficiency. It also known as digital agriculture or smart farming, that exactness agriculture for emerging field that is rapidly transforming the agricultural sector. Automation and robotics figure out with the proffer solution in modern smart farming practices. In addition to autonomous tractors, farmers use robots for tasks like seeding, harvesting and pruning. They can also deploy UAVs to spray fertilizer, pesticides and other agricultural inputs in a manner that can be more efficient and precise than traditional methods. The more precise and limited application of fertilizer, in particular, we can have a

remarkable environmental impact: fertilizer is a significant source of greenhouse gas emissions. It involves the use of technology and data analytics to optimize agricultural practices and increase efficiency in crop production. Smart agriculture encompasses a range of technologies, such as sensors, drones, satellite imagery, and data analytics, that are used to monitor crop growth, soil conditions, and weather patterns. The use of these technologies allows farmers to make more informed decisions about planting, harvesting, and storage. It also helps to optimize irrigation, fertilization, and pest control practices, ultimately leading to higher crop yields and reduced waste. (Gantz et al., 2017) Automation is another key feature of smart agriculture, as it allows for more efficient and cost-effective farming practices, such as automated irrigation systems and robotic harvesting equipment. Smart agriculture represents a significant opportunity to improve the sustainability and productivity of agriculture. It can help farmers to make more informed decisions, reduce waste, and increase efficiency, ultimately leading to a more sustainable and profitable agricultural sector. (Cassidy and Snyder, 2019) The benefits of smart agriculture are numerous, including increased efficiency, reduced waste, and improved sustainability. It can also help to reduce the environmental impact of agriculture by reducing the use of pesticides and fertilizers, as well as reducing greenhouse gas emissions

Through more efficient of farming practices. Overall, smart agriculture is a promising solution to many of the challenges facing the agricultural sector, including food security, environmental sustainability, and

Economic growth. As technology continues to advance, the potential for smart agriculture to transform the industry is immense.

LITERATURE REVIEW

In the agriculture sector, modern and progressive technologies is used to offer the best opportunities for collecting and processing information for making decision, while at the same time to increasing the net of productivity. Therefore, some of technological innovations such as the use of drones in the agriculture sector for plant genetic, precision technologies, machines, wireless sensor network, intelligent solar and wind energy, root technology applications based on artificial intelligent and large scales desalination technology. Ajibola and Adekunle. (2018) With the timely agriculture Smart Agriculture for Sustainable Food Production in Nigeria" This study highlights the need for smart agriculture in Nigeria to improve food production and achieve sustainable development. The authors discuss the challenges facing agriculture in Nigeria and how smart agriculture can help to overcome them. They also propose some smart agriculture technologies to implemented in Nigeria, this study explores the benefits of smart agriculture in Nigeria, such as improved crop yields, reduced resource wastage, and increased profitability in agricultural business in entire country. The authors also discuss some of the challenges facing the adoption of smart agriculture in Nigeria, such as the lack of infrastructure, inadequate funding, and low literacy levels of technology. They propose some solutions to overlook these challenges, such as public-private partnerships, farmer education, and government incentives. Smart Agriculture in Nigeria: This study examines the challenges and opportunities of smart agriculture in Nigeria. The paper address some of the technologies that can be used in smart agriculture, such as precision farming, big data analytics, and internet of things IoT

Refers to a network of physical devices, vehicles, appliances and other physical objects that embedded with sensors, software and network connectivity that allows them to collect data.

In the Case of smart farming, IoT devices includes many kinds of IoT sensors, including sensors for monitoring crops, tracking livestock and observing the condition of farm equipment sensors. They also explore some of the challenges facing the adoption of smart agriculture in Nigeria, such as the high cost of technology, inadequate infrastructure, and low literacy levels. The authors propose some solutions to overcome these challenges, such as government support, public-private partnerships, and farmer education. Smart Agriculture in Nigeria: A Review of Current Trends and Future Prospects" by Raj Kumar goel (2021), this study provides an overview of smart agriculture in Nigeria, including the technologies used, the benefits, and the challenges facing the sector.

Some of the technologies that can be used in smart agriculture. They also explore some of the challenges facing the adoption of smart agriculture in Nigeria, such as the lack of infrastructure, inadequate funding, and low literacy levels. The authors propose some solutions to overcome these challenges, such as government support, public-private partnerships, and farmer education. These studies highlight the importance of smart agriculture in Nigeria and the challenges facing its adoption. They propose some solutions to overcome these challenges, which can help to improve agricultural productivity and achieve sustainable development in Nigeria.

Smart Agriculture Challenges and It Solution

These challenges are including funding, capacity building, and poor technical skills. Other challenges can be stated lack of synergy, coordinating and collaboration by stakeholders, and a lack of target- setting, monitoring and evaluation, which gave room to overlaps, duplication of efforts and greater cost Borden, more than 80% of farmers in Nigeria are smallholders who grapple with fragmented lands, poor soil fertility, weeds pest and diseases.

Artificial Intelligence as a New Tool for Agriculture

Modern scientific improvements, breakthrough results and the success of particular applications have brought artificial intelligence (AI) into the attention. AI systems are already being deployed or piloted in many sectors including automotive, financial, manufacturing, health, security, and government. Artificial intelligence (AI) is a rapidly growing field that has the potential to revolutionize agriculture. AI refers to the development of computer algorithms that can perform tasks typically associated with human intelligence, such as learning, problem-solving, and decision-making. Here are some of the ways in which AI used as a new tool for agriculture:

1. Accuracyin Farming: AI use to develop precision farming techniques, such as the use of sensors and data analytics to optimize irrigation, fertilization, and pest control practices. This can help to reduce waste, increase efficiency, and improve crop yields.

2. Crop Monitoring: AI use to monitor crop growth and detect potential issues, such as disease or nutrient deficiencies, before they become problems. This can help farmers to make informed decisions about management practices and improve crop yields.

3. Autonomous Farming Equipment: AI use to develop self-directed farming equipment, such as drones and robots that can perform tasks such as planting harvesting, and spraying. This can help to reduce labor costs and increase efficiency in agriculture.

4. **Predictive Analytics:** AI use to develop predictive analytics models that can forecast crop yields, weather patterns, and other factors that can affect agricultural production. This information can be used to optimize planting and harvesting practices and make informed decisions about crop management.

5. Soil Analysis: AI use to analyze soil samples and provide recommendations for the optimal type and amount of fertilizer to use. This can help to reduce waste and improve crop yields.

Promoting Agriculture using Artificial Intelligent in Nigeria

In a simplyterm AI refers to a family of technologies that allow computers and other machines (e.g. robots) to perform tasks previously thought to rely on human experience, creativity and resourcefulness. It now involves the ability of machines to function separately, and "learn" from large volumes of input data, without being unambiguously programmed for the required task.

In most AI systems, learning happens by continuous adjustment of a broad set of parameters based on training data to show the system the correct output expected when provided with a given input. (Kumar *et al.*, 2020). This involves the use of machine learning algorithms and more recently deep learning. Broadly speaking, this approach attempts to mimic the process of natural learning whereby a person gradually develops certain knowledge and skills through continuous trial and error. Some key advantages of such an approach are overcoming the challenge for human programmers to develop multivariable algorithms for complex tasks (which they may not be able to do) and allowing for the greater flexibility and swiftness of the algorithms. As AI systems learn, they are able to approach or sometimes exceed human performance in particular areas. **Application Areas in smart agriculture Farming**

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The following some of the broad areas of AI application in agriculture include.

- Crop, soil, and livestock monitoring. AI systems can support farmers in monitoring the condition of their crops, soil, and livestock and provide timely recommendations on particular actions and decisions. For example, by analyzing inputs from field sensors or studying images, AI algorithms can help determine the best time to sow seeds, collect fruits, spread fertilizers and/or provide specific treatment to cattle. They can also help detect which particular plants or animals require an intervention, thus allowing for more efficient use of resources.
- Detection of pests and diseases. AI systems can examine digital images taken by drones, agricultural robots, or farmers using a simple smart phone camera to detect pests and give concrete advice to agricultural workers on how to prevent their spread, real affected plants or mitigate the damage caused. At the same time, AI can analyze data on the behavior of livestock to detect abnormalities and identify potentially causes, thus allowing timely treatment.

- Weather and temperature forecasting. AI algorithms are able to assist farmers with local weather and temperature forecasting using historical data and measurements made by local weather stations and field sensors. Better weather and temperature forecasting. Can help framers to make better decisions on when to strew seeds, apply pesticides and plan for harvesting. Predict demand for a particular agricultural product. These predictions can be communicated to producers to avoid any shortage or oversupply.
- Independent agricultural automatons and farm equipment. AI systems can be deployed on robotic platforms to direct and control their work performing assistive tasks, such as targeted irrigation, application of fertilizers and pesticides, collection of fruits and transporting equipment around a farm among others. Areas of application are unlikely to remain static and as technology and user needs evolve, new applications may emerge, such as using AI to access finance and insurance for small-scale farmers. With AI-powered analytical tools, lenders can better evaluate credit risks and lend money more confidently to small farmers to help them expand production. (Cline, 2019) Combined with big data and improved connectivity (i.e. with the arrival of 5G), AI could also improve tracking of agricultural production to monitor product quality, enforce responsible conduct and practices and track food distribution and delivery.

Factors Affecting the Use of Smart Agriculture in Nigeria

The Nigerian Government shall improving the access to technology, providing adequate infrastructure, increasing literacy levels, reducing the cost of technology, and providing government support are crucial in promoting the use of smart agricultural technologies in Nigeria's economy with the following idea.

1. Limited access to technology: One of the significant factors that affect the use of smart agriculture in Nigeria is the limited access to technology. Many farmers in Nigeria do not have access to smart devices such as smartphones, laptops, or tablets, which makes it difficult for them to utilize smart agricultural technologies.

2. Lack of infrastructure: The inadequate infrastructure in Nigeria, such as poor internet connectivity and power supply, also affects the use of smart agriculture. Smart agricultural technologies require a reliable and stable internet connection, which is not readily available in most rural areas in Nigeria.

3. Low literacy level: Many farmers in Nigeria have a low literacy level, which makes it difficult for them to understand and use smart agricultural technologies. The use of smart agricultural technologies requires a certain level of technical knowledge, which is not readily available among most farmers in Nigeria.

4. **High cost of technology:** The high cost of smart agricultural technologies is another factor that affects the use of smart agricultural system in Nigeria. Many farmers cannot afford to purchase these technologies due to their high cost, which limits their access to these technologies.

5. Lack of government support: The Nigerian government has not provided enough support for the adoption of smart agricultural technologies. This has led to limited awareness and understanding of the benefits of smart agriculture, which has affected its adoption in Nigeria.

The Implementation of Smart Agriculture in Nigeria

The implementation of smart agriculture in Nigeria is possible, but it requires significant effort and huge investment from the government. Here are some reasons why it is possible:

1. Agricultural potential: Nigeria has vast agricultural potential due to its fertile soil and favorable weather conditions. The implementation of smart agricultural technologies can significantly increase yields and improve overall agricultural productivity both local and international.

2. Increasing adoption of technology: Nigeria is gradually adopting technology in various sectors, including health care sector agriculture and educational system. This is evident in the increasing adoption of mobile phones and other smart devices, which can be leveraged to implement smart agricultural technologies.

3. Government support: The Nigerian government is beginning to recognize the importance of agriculture and is making efforts to improve the sector. For instance, the government has launched various agricultural initiatives and programs aimed at improving agricultural productivity, which can be leveraged to implement smart agricultural technologies.

4. Private sector investment: There is a growing interest from the private sector in investing in agriculture system in Nigeria. This investment can be leveraged to implement smart agricultural technologies.

5. Growing population: Nigeria has a growing population, which means there is a need to increase food production to meet the growing demand. The implementation of smart agricultural technologies can help to achieve this goal. In conclusion, while there are challenges to implementing smart agriculture in Nigeria, it is possible with the right investment, support, and infrastructure.

Promoting Smart Agriculture in Nigeria:

1. Increase awareness and educate the Farmers: A lack of awareness and education is one of the significant challenges facing the adoption of smart agriculture in Nigeria. The government and other stakeholders should invest in awareness campaigns and training programs to educate farmers on the benefits of smart agriculture and how to use the technology for transformation.

2. Improve infrastructure: Inadequate infrastructure, such as poor road networks, electricity supply, and internet connectivity, is a significant challenge that might faceadoption of smart agriculture in Nigeria. The government should invest in improving infrastructure to provide farmers with the necessary resources to utilize smart agriculture technologies system of farming.

3. Promote public-private partnerships: Public-private partnerships can help to promote smart agriculture in Nigeria by providing farmers with access to technology and funding. The government should encourage partnerships between private companies and farmers to promote the adoption of smart agriculture.

4. **Provide financial support:** Smart agriculture technologies can be expensive to implement, and many farmers in Nigeria cannot afford them. The government should provide financial support in the form of grants and loans to help farmers adopt smart agriculture technologies.

5. Develop policies to support smart agriculture: The government should develop policies that support the adoption of smart agriculture in Nigeria. These policies should encourage the use of technology, provide incentives for farmers to adopt smart agriculture, and address any regulatory barriers to adoption.

6. Develop local solutions: develop Local solutions thatmodified a specific need of Nigerian farmers, which can help to promote the adoption of smart agriculture. The government and other stakeholders should support the development of local solutions that address the challenges facing Nigerian farmers.

In conclusion, promoting smart agriculture in Nigeria requires a multifaceted approach that involves improving infrastructure, increasing awareness and education, promoting public-private partnerships, providing financial support, developing policies to support smart agriculture, and developing local solutions.

Conclusion

Nigeria as a nation should be technologically self-reliant in the production of capital and consumer goods and raw materials. The educational system shall emphasize science at all levels and re-orient the important of smart technology We must ensure the acceptable development of smart agriculture in our farming system science and technology to guarantee the efficient utilization of abundant natural resources and reduce channel on outside sources for industrialization production the entire society should developed towards scientific thinking in in order to developed new technologies and adapt existing ones to improve societal wellbeing on food security

Recommendation

Human resources development, demand for knowledge in the private sector, public support of science and technology and access to information and communication technologies for the benefit of smart agriculture (ICT).

(i) Policies for science and technology in human resources development aim to provide science educational training at the basic secondary and tertiary level, prepare young people enter a diverse labor force that requires various levels of science and technology (ii) "Implied" policies for science and technology create an enabling environment that stimulates demand for knowledge in the private sector through, inter alia, a stable macroeconomic environment.

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