



## ABSTRACT

This study explores the potential of harnessing innovation in agriculture to drive productivity and food security in Nigeria. Against the backdrop of global agricultural challenges and the historical context of Nigerian agriculture, the study investigates the importance of innovation in addressing issues such as low productivity, inadequate technology adoption, and limited access to resources. Drawing on the theoretical framework of Innovation Diffusion Theory, the research examines the challenges hindering

# HARNESSING INNOVATION IN AGRICULTURE: DRIVING PRODUCTIVITY AND FOOD SECURITY IN NIGERIA

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## Introduction

Agriculture is critical to sustainable development and poverty alleviation (Barrows et al., 2014). The global backdrop for agriculture has altered considerably, and despite widespread adoption and development of the agricultural extension program, substantial obstacles persist (Feder et al., 2010). In recent years, phone-based agricultural advising services have expanded to capitalize on the introduction and expansion of mobile phone networks (Fabregas et al., 2019). Some research has proposed both substantial and inconsequential ways in which SMS-based agricultural information might influence farming outcomes (Nakasone et al., 2016). It is uncertain if changes in program design or methodological issues in program evaluation have broad implications (Norton & Alwang, 2020).

The agricultural and food sectors are facing several issues. Food consumption is predicted to increase significantly as the global population grows from 7.6 billion in 2018 to more than 9.6 billion in 2050 (UN DESA, 2019). At the same time, natural resources like fresh water and productive agricultural land are becoming rarer. This rapid population growth will put immense pressure on the agricultural industry to produce more food with limited resources. Sustainable farming practices and technological innovations will be crucial in addressing these challenges and ensuring food security for future generations.

Digital agriculture refers to the use of digital technologies to integrate agricultural output from paddock to customer. Agricultural enterprises can profit from these technologies since they provide additional tools and information for making better decisions and increasing production. Sensors, automation, and robotics are being used in production systems as part of digital farming technology



the adoption of innovation in Nigerian agriculture, including lack of awareness, high costs, insufficient information, and limited access to inputs and financial resources. Through analysis of existing literature and empirical data, the study aims to provide insights into strategies for promoting innovation adoption among small-scale farmers in Nigeria, ultimately contributing to enhanced agricultural productivity and food security.

**Keywords:** Agriculture, Innovation, Productivity, Food Security, Nigeria.

(Banhazi et al., 2012; Shamshiri et al., 2018). These tools can help monitor crop growth, soil conditions, and livestock health in real-time, allowing farmers to optimize their resources and improve efficiency. By utilizing digital agriculture, farmers can also reduce environmental impact and improve sustainability practices in their operations.

In rural parts of developing nations, where the majority of people rely on agriculture for a living, digital technology can help reduce global poverty and hunger faster. Farmers in digital agriculture employ mobile phones and other technology that has the potential to transform community livelihood security and improvement (Kremer & Hounbo, 2020). By providing access to information on weather patterns, market prices, and best agricultural practices, digital technology can increase crop yields and income for farmers. This ultimately leads to improved food security and economic stability in these communities.

Although agricultural output is already adequate to feed the globe, 821 million people remain hungry (FAO, 2018). Rapid urbanization has a profound influence on food demand and supply patterns. The agrifood industry is crucial for livelihoods and jobs. Over 570 million smallholder farms exist globally (Lowder et al., 2016), and agriculture and food production employ 28% of the global workforce (ILOSTAT, 2019). To accomplish the UN Sustainable Development Goal of a "world without hunger" by 2030, food systems must be more productive, efficient, sustainable, inclusive, transparent, and resilient (FAO, 2017). The present agrifood system will have to be altered quickly. This will require significant investments in research, technology, infrastructure, and policy changes to ensure food security for all. Collaboration among governments, businesses, and communities will be essential to address the challenges of food insecurity and create a more sustainable future for agriculture and food production. Its against this backdrop, this study seeks to investigate harnessing innovation in agriculture: driving productivity and food security in Nigeria.

### Overview of Agriculture in Nigeria

Agriculture is described as the art or science of growing foods and raising animals for human benefit. It has also been defined as the science, art, or practice of cultivating soil, growing crops, and keeping livestock for the ensuing products (Marriam-Webster, 2021). Essentially, agriculture cultivates both food and cash crops and raises various types of animals in order to create food for humans and raw materials for agro-allied businesses. According to Aremu et al. (2010), the most significant job of agriculture in every nation is to provide food, which is also required by humans



for energy, body construction, cell repair, and body defense. Vegetables, fruits, grains, legumes (including dry beans, spices, herbs, seeds, and nuts), beverage plants like tea, cassava, maize, potatoes, rice, sorghum, soya beans, sweet potatoes, wheat, and yams are examples of food crops. Cash crops, on the other hand, are agricultural commodities grown primarily for the purpose of selling them to local businesses or exporting for profit. It is also known as a profit crop and is often acquired by parties outside of a farm. The word distinguishes between sold crops and subsistence crops, which are grown for human consumption.

Subsistence agriculture was the norm in pre-colonial Nigeria, with farmers focusing on cultivating and producing food crops to sustain themselves and their families. Although the building was not static, it needed a family and a large plot of land on which members of the family utilized rudimentary and crude equipment to cultivate food for the household. Environmental and climatic considerations influenced farming techniques in widespread communities (Alexander, 2022). For example, in the northern region of Nigeria, farmers adapted their practices to the arid conditions by utilizing irrigation methods such as digging wells and constructing channels to water their crops. In the southern region, where rainfall was more abundant, farmers relied on natural precipitation for their agricultural needs.

According to Faluyi in Kehinde (2013), the origins and dissemination of agriculture are unclear, although it is widely agreed that knowledge of agriculture began in Egypt in the late sixth or early fifth millennium B.C. He went on to say that the early Egyptians most likely learned about crop and animal domestication from the inhabitants of Syria and Mesopotamia, who had been practicing the skill during that time period. However, not all researchers agree with this perspective, which holds that agriculture in West Africa originated in North Africa and is commonly associated with the Hamitic theory. Wickins, for example, claims that agriculture in Sub-Saharan Africa arose independently of Egypt, although three millennia later (Oyemakinde, 2005). The old version asserts that after agriculture was developed in Egypt, it formed a new center from which knowledge moved southward to other communities such as Nigeria. According to the same source, grain farming, specifically wheat and barley, began in the Near East 10,000 years ago and moved up the Nile Valley and westward via the Savannah Corridor to West Africa around 1500 years before Christ. Wickins further argued that the conducive environment with abundant resources of the tropical savannah provided the small realistic hunting communities with all they needed in terms of food supply and gave them nearly the same living standard, so they did not see the need to develop cereals and domesticate flocks, resulting in a time lag in agricultural advancement (Alexander, 2022). Whatever the debate over crop domestication and the transition to an agrarian economy as opposed to the hunting period, Africans, particularly those in Sub-Saharan Africa, borrowed and adapted several crops at an early date, including several types of millet, yams, an indigenous form of groundnut, oil palms, and rice.

Land has long been an important role in production, is essential for farming, and is regarded as a source of life. Land was communally owned and allocated based on the requirements assessed by the household head. As the population grew, the community land was continually redistributed. Farming was augmented with other occupations including as animal husbandry, hunting, fishing, manufacturing, and collecting, and agriculture eventually became the principal activity of all Nigerian ethnic groups. Agriculture was referred to as "the Igbo staff of life" among the Igbo. Every



Igbo man and woman were farmers. Most families produced enough basics including yam, cocoyam, cassava, and vegetables (Adewoye 2011). Similarly, the Yorubas and Hausas, the Edos, Igala, Nupe, Isan, Ibibio, and Efik, among others, made farming their primary employment. As much as the colonial officials desired complete control, the practical realities of the situation required them to allow Nigerians to take some initiative in the direction of their economic affairs. Infrastructural changes such as rail and road construction and certain export crops such as cocoa, coffee, electricity, and currency benefited the traditional economy by strengthening its ties to the global economy, but they also made it vulnerable to global risks such as the 1930s economic depression. It should also be noted that the colonial period saw the introduction of money, with the British government introducing pounds, shillings, and pence as well as additional agricultural incentives to encourage output (Alexander, 2022). Additionally, the colonial period brought about changes in land ownership and labor systems, impacting the traditional economy's structure. These shifts often led to social unrest and resistance among local populations against colonial rule. According to Akindele (1988), for a long time, and until the end of the 1960s, Nigeria's economic growth and development were primarily stimulated and driven by agricultural output for export. Because more than 70% of Nigeria's working population is engaged in peasant and non-mechanized agriculture, no economic historian can ignore the agricultural sector's nerve-centeredness and multidimensional importance in the Nigerian nation's social and economic life, despite the fact that agriculture's share of GDP has been steadily declining since 1960. Nigeria's agricultural resource strength and potential, as previously said, are defined and determined by the country's geographical position, terrain, climate, soil, and vegetation. The typical variety of the country's agricultural resources, which range from 40 to 140 degrees north of the equator. This geographical location allows for the existence of a wide range of distinct and diverse ecological zones, including the mangrove swamp, high forest, guinea savannah, and dry Savannah, all of which contribute to and enable the existence of a variety of agricultural production for both domestic consumption and export.

Nigerian agriculture has traditionally suffered from a general problem of low productivity resulting from nonmechanization, low level of agricultural technology, insufficient or misapplication of fertilizers and pesticides, poor production techniques, an archaic system of land tenure, and underinvestment. Notwithstanding the launching of the agriculture revolution schemes, it is obvious that with the state of the dwindling fortunes of the country in the agricultural sector, there is a need for a much greater allocation and a more spirited mobilization for the agricultural sector of the economy (Alexander, 2022). Furthermore, there is a need for comprehensive training and education programs to improve the skills and knowledge of farmers. Implementing modern farming techniques and technologies can also help increase productivity in the agricultural sector.

### **Importance of Innovation in Agricultural Development**

Agriculture is one of the oldest sectors in every economy. It is an important sector since its purpose is to supply nutrition to the populace. The fundamental factor in production is land, which has a restricted size. It is an irreversible factor with a fixed size (Kuzevicova et al., 2013). Thus, growing agricultural output requires more effective land use and the use of cutting-edge expertise. In many nations, agriculture that incorporates innovative features is an important engine of economic



development (Ayodele et al., 2019). Agriculture has provided great advantages. Agriculture has always been one of the country's most important economic sectors (Popov, 2017). Furthermore, agriculture plays a crucial role in providing employment opportunities for a significant portion of the population, especially in developing countries. Additionally, advancements in agricultural technology have led to increased productivity and efficiency in the sector, contributing to overall economic growth.

Currently, the growth of any sector requires adhering to the principles of sustainability, which include economic, social, and environmental development. Furthermore, farming is an important sector for guaranteeing sustainable growth. Environmental challenges are becoming increasingly important in generating more significant economic growth. Globalization and urbanization have an impact on lifestyles and consumer behavior. Sustainable economic growth entails promoting environmentally friendly policies at all financial levels as well as transforming consumption and production so that human and economic activities contribute to a sustainable society (Aceleanu, 2016). It is crucial for governments and businesses to prioritize sustainability in their decision-making processes to ensure long-term success. By investing in renewable energy sources and promoting green technologies, countries can achieve a balance between economic growth and environmental preservation.

Agriculture's relevance is not determined by its size or percentage of total economic production. This sector's performance accounts for a minor portion of the global economy, yet it remains vital to many people's daily lives. Life is impossible without the goods of this industry (Dobrovic et al., 2016). Agriculture provides the food and resources necessary for survival, making it a crucial component of society. Its impact extends beyond economic measures, influencing everything from culture to health.

### **Theoretical Framework**

This study adopts Innovation Diffusion Theory as the theoretical framework of analysis.

Rogers (1995) improved on the Innovation Diffusion Theory, which was first proposed in 1962. Innovation diffusion theory seeks to understand how, why, and at what pace creative ideas and technology spread within a social system. Rogers' work expanded on the original theory by incorporating factors such as communication channels and social systems, providing a more comprehensive framework for analyzing innovation adoption. This enhanced understanding has since been widely applied in various fields, including marketing, sociology, and public health.

Innovation Diffusion theory provides a different method for studying changes than other change theories. Instead of focusing on convincing people to change, it sees change as largely about the development or "reinvention" of goods and behaviors to make them more suited to the requirements of individuals and communities. The inventions themselves change, not the individuals who spread them (Les Robinson, 2009). Innovation diffusion theory emphasizes the importance of understanding how innovations are adopted and spread within a society. By recognizing the role of social networks and communication channels in this process, it offers insights into how to effectively introduce new ideas or products.

Everett Rogers created this theory, which may be used to better understand how new agricultural technology and practices are embraced and disseminated among Nigerian farmers. It investigates



how innovations are conveyed through specific channels throughout time among members of a social system. Understanding the diffusion process can assist in developing successful methods for propagating novel agricultural techniques and technology throughout Nigeria's agricultural landscape.

### **Challenges Hindering the Adoption of Innovation in Nigerian Agriculture**

The widespread lack of awareness among small-scale farmers may contribute to their high prevalence of illiteracy. This contributes to the widespread acceptance of current innovation. The nature of the distribution of innovation influences its acceptance. Agricultural demonstrations and personal interaction between farmers and extension agents have been linked to the adoption of certain innovations (Adeyemi et al., 2023). Therefore, increasing access to educational resources and training programs for small-scale farmers can help improve their literacy levels and ultimately enhance their acceptance of new innovations in agriculture. Additionally, creating more opportunities for direct engagement and knowledge-sharing between farmers and extension agents can further facilitate the adoption of innovative farming practices.

Obisesan (2014) identified the following restrictions to the adoption process of most innovations: high costs of innovation, non-availability of required inputs, a lack of suitable information, and insufficient financial facilities. These restrictions often hinder farmers from fully embracing new technologies or practices, ultimately limiting their ability to stay competitive in the market. Overcoming these barriers requires strategic planning and investment in resources to facilitate the successful adoption of innovations.

Simtowe et al. (2011) believe that the use of newer technology is impacted by a shortage of agricultural inputs, high labor costs, and land tenancy, among other reasons. Adoption of innovation is heavily influenced by the type and efficacy of communication channels. Therefore, it is crucial for agricultural extension services to effectively communicate the benefits and methods of using new technologies to farmers. Additionally, government policies and incentives can play a significant role in encouraging farmers to adopt innovative practices in agriculture.

According to Ekpe and Obetaan (2004), the frequency of extension contact has a considerable impact on agricultural technology adoption. One of the key impediments to innovation adoption is farm product price regulations as well as investment in physical and social infrastructures, which are largely geared toward urban people and industry (Mwangi & Kariuki, 2015). These factors contribute to the limited access and dissemination of agricultural technologies to rural farmers, hindering their ability to adopt new innovations. Addressing these challenges through targeted policies and investments can help improve technology adoption rates in rural areas.

### **Conclusion and Recommendations**

Agriculture innovation is critical to increasing production and guaranteeing food security in Nigeria. Despite the historical importance of agriculture to the country's economy and the immense potential given by its different natural zones, Nigerian agriculture confronts several problems that hamper its growth and development. These issues include low productivity, insufficient technology adoption, restricted resource availability, and inadequate infrastructure. The theoretical framework of Innovation Diffusion Theory provides valuable insights into



understanding how new agricultural technologies and practices are adopted and disseminated among Nigerian farmers. By acknowledging the role of communication channels and social systems in the diffusion process, strategies can be devised to effectively introduce and promote innovative agricultural solutions.

However, adoption of innovation in Nigerian agriculture is hampered by a number of problems, including widespread illiteracy among small-scale farmers, high innovation costs, restricted access to inputs and information, and poor extension services. Overcoming these difficulties will need a collaborative effort from the government, lawmakers, agricultural groups, and stakeholders.

Based on the findings the following recommendations were suggested:

- i. Improve literacy and education levels among small-scale farmers through targeted educational programs and training initiatives.
- ii. Enhance access to information and extension services by investing in digital platforms and communication technologies tailored to the needs of rural farmers.
- iii. Reduce the cost barriers associated with innovation adoption by providing financial incentives, subsidies, and access to credit facilities for farmers.
- iv. Strengthen agricultural input supply chains and infrastructure to ensure the availability and accessibility of necessary resources for farmers.
- v. Promote policies that incentivize the adoption of sustainable and environmentally friendly farming practices, such as conservation agriculture and organic farming.
- vi. Enhance collaboration and partnerships between government agencies, research institutions, NGOs, and private sector entities to facilitate technology transfer, knowledge sharing, and capacity building in agriculture.
- vii. Prioritize investments in rural development and infrastructure projects to address the disparities between urban and rural areas, thereby improving access to agricultural technologies and markets for rural farmers.

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