

Original Article

Impact of COVID-19 Pandemic on Agriculture, Food Systems and Sustainable Food Security in Nigeria: Policy Implications

Augustine Nduka Eneanya

Department of Political Sciences, Faculty of Social Sciences, Department of Political Science
Akoka, Yaba, Lagos, Nigeria

ABSTRACT

Food insecurity has become exacerbated as a result of COVID-19 pandemic in Nigeria. Agriculture, food systems, and food security have faced challenges. The purpose of this study is to assess the impact of the COVID-19 pandemic on agriculture, food systems, and sustainable food security. The study was carried out in Lagos, using video-phone calls to access respondents from Abuja and Delta State in Nigeria. The study adopted an exploratory qualitative research design. Data were collected from primary and secondary sources. Primary sources data were from an in-depth interview of six key informants, while, secondary data were collected from sources, such as extant literature, journal articles, textbooks, the internet, and newspapers. Content-analysis technique was adopted for the collection of the data and analysis. Content-analysis technique was adopted to elicit key concepts, which were edited, sorted, pattern-matched, coded, or categorized into key themes, such as the COVID-19 effect on agriculture, environment, food systems, and sustainable food security. The thematic analysis method was adopted using the conceptual framework

Corresponding Author: Augustine Nduka Eneanya <aeneanya@unilag.edu.ng>

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of constructed integrated system to analyze, interpret and answer the research question. The results revealed that COVID-19 pandemic impacted the agriculture, food system, and food security in Nigeria. The study concluded that COVID-19 pandemic negatively impacted the agriculture, food systems and created food insecurity in Nigeria. The study provided an understanding of the effects of COVID-19 Pandemic on agriculture, food systems, and how to sustain food security. It suggested the reform of agricultural policies for sustainable food security in Nigeria.

Keywords: Agriculture, environment, food systems, food security, and sustainability

INTRODUCTION

Globally, the COVID-19 pandemic, a highly contagious disease emerged in China and spread rapidly from human to human, which affected more than 18 million people (UN,2020). Due to the contagious nature, countries try to put some mitigation measures by declaring lockdowns to curb it. These measures to mitigate the pandemic led to challenges in food systems and supply chains, food insecurity, unemployment, poverty, hunger, and malnutrition, exacerbating the conditions of the poor and vulnerable groups already in extreme poverty and inequality worldwide (Schlein, 2020).

Nigerian economic activities were negatively affected by the emergence of the COVID-19 pandemic. The prices of oil which was the main export crop of Nigeria fell in the international market because of reduced global demand for oil. This affected the country's fiscal and external financial positions affecting foreign exchange proceeds by 30 percent in the mid-month of April 2020 and moving to its worst price of \$18.94 per barrel (CBN Report, 2020). Other sectors affected by the economy were e-commerce and agriculture. E-commerce also recorded a loss of Euro 37.6 million (N17.1 billion) in the second quarter of 2020(CBN, 2020).

Before COVID-19 pandemic in Nigeria, agriculture contributed to Gross Domestic Product by an average of 24.6 percent from 2015 to 2019. Agriculture's contribution to Gross Domestic Product in the first quarter of 2020 was 22 percent compared to oil and gas (9.5%), manufacturing (9.7%), financial services (3.8%), and trade (16.1%) (NBS, 2020). Besides, the consequences of climate change on the environment, for example, the pollution of air, environmental degradation, and the use of fossil fuel as a source of energy also affected agriculture, food systems, and food security creating poverty and inequality. Besides, many challenges affected agricultural activities, such as Boko Haram insurgency, Herders-farmers conflict, cattle rustling, banditry, pests or locust scourge, flooding lack of access to finance, and absence of value addition and supply chains linkages (FAO, 2020).

With the emergence of the COVID-19 pandemic, these challenges facing Nigeria deepened (FAO, 2020). Since COVID-19 emerged in Nigeria's environment on February 27, 2020, through an Italian –index case (Ugbodaga, 2020), over 54,463

victims were recorded of July 25, 2020, in all states of the federation. 42,439 cases were discharged and 1027 were deaths recorded on September 3, 2020 (NCDC, 2020).

It affected the agricultural environment, food systems, and food security in Nigeria

The agricultural environment in this study refers to the environment for the production and consumption of food, the food system, and other supply value chains, such as processing, packaging, marketing, distribution, and packaging. The food systems involve many actors in the production, processing, distribution, marketing, packaging, and storage of food supply chains. The food systems require careful management of land, soil, and water through integrated approaches (UN, 2020).

Food security in this study also means that every person in a given area has daily access to enough nutritious foods to have an active and healthy life (Miller and Spoolman, 2008, 199). Food security also depends on greatly reducing the harmful environmental effects of agriculture – such as soil erosion, and aquifer depletion at the local, national, and global levels (Miller and Spoolman, 2008, p. 2000). Those who cannot grow or buy enough food to meet their basic energy needs suffer from chronic under-nutrition or hunger” (Miller and Spoolman, 2008 & 2000).

In Nigeria, the food insecurity challenges have become more alarming as a result of the COVID-19 pandemic: These challenges are also not unconnected with nature, such as; climate change, urban sprawl, environmental degradation, loss in diversity, and deforestation, among others. All these disrupt the efficient functioning of the food systems. It is believed by scientific agricultural experts that technological innovations would boost agricultural gains and sustain food security in Nigeria. The international community offers many such innovative technological tools. With concerted action by multi-stakeholders, more sustainable food systems that are balanced with nature would enhance agricultural productivity gains in Nigeria (UN, 2020).

The concept of sustainability means valuing the environment as they utilize resources with current and future needs of the people in mind. Miller and Spoolman (2008) define sustainability as the “ability of the earth’s various natural systems and human cultural systems and economies to survive and adapt to changing environmental conditions indefinitely” (p.7). So, living sustainably means living off natural income, the renewable resources such as plants, animals, and soil provided by natural capital. This means not depleting or degrading the earth’s natural capital which supplies this income and providing the human population with natural capital and natural income for the foreseeable future (Miller & Spoonlman, 2008).

These concepts clarified above are synthesized into a conceptual framework for the analysis of this study. The integrated system conceptual framework (fig.1) was, therefore, adopted as a framework of analysis for this study. It is made up of inputs, conversions, outputs, and outcomes. The inputs consist of biophysical environmental issues such as land, water, and Air. The agricultural environment includes political, economic, demographic, socio-cultural, and environmental issues, such as climate

change, deforestation, degradation of ecosystem, food security, and malnutrition. The food systems have actors, who are involved in food production, processing, packaging, marketing, distribution, storage, and others with the supply value chains. These actors' activities in the food systems (conversion process) are guided and regulated by policies, programs, laws, and regulations legitimized by the legislature and reflected as outputs. The policies and programs are implemented by the executives and bureaucrats through institutional actions within the political, agricultural, economic, and social policies in the internal and other factors from external environment influencing public policies and programs, and outcomes (Eneanya, 2021). The integrated system framework is justified for this study because the system approach is one of the several possible levels of analysis of the policymaking process (Dye, 1996). Moreover, it enables the stakeholders to understand the pattern of relationships between the agricultural environment, food systems, and sustainable food security (Edwards, 2004; Edwards et al. 2001)

The general objective of this study, therefore, is to assess the impact of COVID-19 pandemic on the agricultural environment, food systems, and security in Nigeria. The specific objectives are:

- (i) To understand the impact of the COVID- 19 on agriculture in Nigeria
- (ii) To explore the impact of the COVID-19 pandemic on the food systems in Nigeria
- (iii) To explore the impact of the COVID-19 pandemic on food security in Nigeria

In light of these objectives, the study is driven by the following four research questions:

RQ. 1: What are the effects of COVID-19 pandemic on agriculture in Nigeria?

RQ. 2. What are the effects of COVID-19 pandemic on food systems in Nigeria?

RQ.3 What are the effects of COVID-19 pandemic on food security in Nigeria?

Against this background, the chapter is divided into five sections. Section one examines the introduction, objectives of the study, and research questions. Section two assesses the impact of COVID-19 on the agricultural environment. Section three assesses the impact of the COVID-19 pandemic on the food system in Nigeria. Section three assesses the impact of the COVID-19 pandemic on food security in Nigeria. Section four examines the policy implications of the impacts of COVID-19 pandemic on the agricultural environment, food system, and sustainable food security in Nigeria. Lastly, section five discusses and concludes the study.

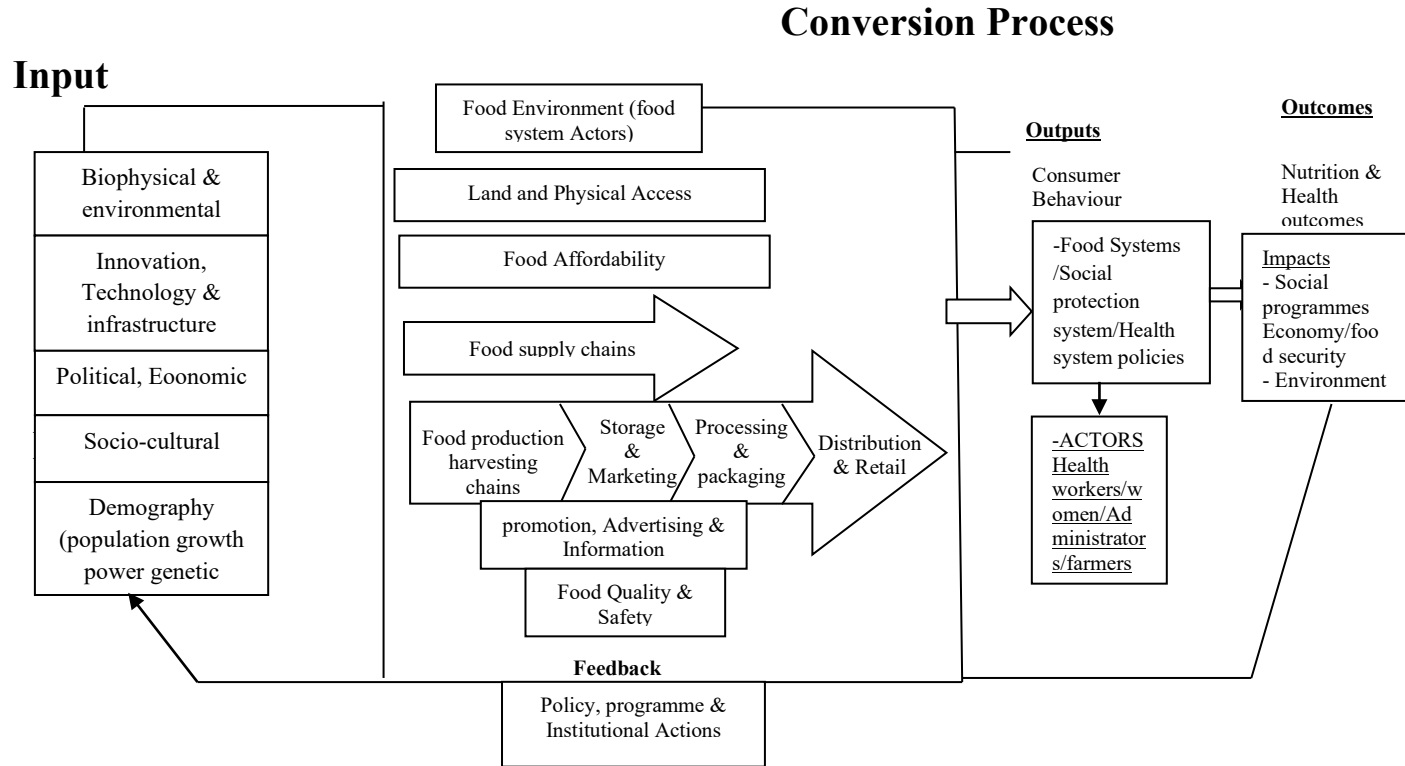


Fig 1: Constructed integrating system approach as Conceptual Framework of Analysis Adapted from Covenant University Journal of Politics and International Affairs (Special Edition), Vol. 9 (1), September, 2021 (PDF)

MATERIALS AND METHODS

For the methods of study, data were collected from primary and secondary sources. An In-Depth Interview (IDI) technique was adopted to interview six key informants, using online video calls. The Key Informants included: two officials from Federal Ministry of Agriculture and Rural Development in Abuja, Nigeria; one Director from Delta State Ministry of Agriculture and natural resources; one expert Agriculturist involved in transportation of raw agricultural foodstuffs, and marketing from rural to urban centers and two rural farmers from Delta State, Nigeria. Secondary sources of data were collected from extant literature, journal articles, textbooks, existing government records and statistics, the internet, and newspapers. Content-analysis technique was adopted to collect and analyze data simultaneously. Moreover, the content-analysis technique was utilized to elicit key concepts, which were edited, sorted, pattern-matched, and categorized into key themes, such as the effect of the COVID- 19 on agriculture, food systems, and food security. Thematic and secondary data analysis methods were adopted to analyze, interpret and answer research questions. These materials and methods are justified because they made it possible to have insight and understanding of the effects of the COVID-19 pandemic on agriculture, food systems, and food security in Nigeria. Previous studies support this approach of “using thematic and secondary data analysis methods to answer research questions in exploratory qualitative research” (Gilbert, 1999; Knight, 2002,182; Yegidis and Weinbach, 2002).

ETHICAL CONSIDERATION

Since the research involves an In-depth Interview using video-phone calls, an investigation proceeded by seeking the six participants’ consent before presenting open-ended questions. The participants in the study were fully briefed about the inquiry and were also informed that they could withdraw their consent at any point during the interview. The questions were designed to be straightforward and logical. Probing questions were also posited to a participant for further clarification and understanding of the questions. The participants were assured of confidentiality of their views and treated with dignity.

RESULTS

Impact of Covid-19 Pandemic on Agriculture

COVID-19 pandemic reduced demands for perishable products, such as tomatoes, pepper, frozen meat, and fish, which led to reduced earnings for smallholder families, farmers, whole-sellers, retailers, and other small-scale producers. This in turn hindered the producers’ access to inputs and disrupted production.

Access to Agricultural inputs for crop production such as inorganic fertilizers, pesticides, and herbicides was limited. It was reported that 72 percent of farming households that needed inorganic fertilizers and 47 percent of farming households that needed pesticides could not access them (NBS 2020).

Participants 1, 2, and 3 interviewed, they claimed that “poorer farmers were seriously affected by COVID-19 pandemic on farming inputs. Lockdown affected their movement to farms, leading to hunger for their families” (IDI, April 4, 2021)

This respondents’ position was corroborated by the report from the National Bureau of Statistics (NBS, 2020) that 81 percent of the poorest quintile of farming households that sought to use inputs were not able to access at least one input, compared to just 49 percent of farming households in the richest quintile. Documentary evidence also revealed that lack of money and increase in prices of food items was the predominant reasons households could not purchase these staple food items, indicating the impact of COVID-19 disease on the agricultural environment (CBN, 2020)

In the external environment, economic activities in terms of inter-regional trade were hampered by the COVID-19 pandemic, leading to losses in regional agricultural product export demand (FAO, 2020). The border closure and air travel ban affected agriculture production, food systems processing, packaging, storage, marketing, distribution, and other businesses in hospitality, tourism, travel, aviation, and their supply chains, among others. According to participants 4, 5, and 6 responses, “the barrier to trade was disrupted in both domestic and international food supply chains, such as export and import trades, wholesalers, retailers, and informal food sellers” (IDI, June 11, 2021). The ban on imports and export affected food price volatility in international markets and threatened food security, leading to poverty, inequality, hunger, and malnutrition in large proportions of the Nigerian population (FAO, 2020).

Impact of Covid-19 Pandemic on Food Systems

The food systems can work together to provide Nigeria’s population with nutritional needs. There was also disruption in the economic and food systems by the COVID-19 pandemic because the mitigation measures of lockdown and social restriction affected not only food systems, but other players involved in Agro-businesses, such as production and harvesting, storage, transportation and marketing, processing, packaging, distribution and retailing (FAO, 2020, NBS, 2020).

The responses of the participant 4, 5, and 6 in the in-depth interview can be paraphrased, thus, “no transport vehicle to bring foodstuffs from rural areas to urban centers. Interests on loans borrowed from commercial banks for our farms were rising with no hope of repayment” (IDI, April 11, 2021)

Documentary analysis from secondary sources revealed that the Central Bank of Nigeria on March 16, 2020, announced various policy measures to this effect and acknowledged that COVID-19 has significantly affected Nigeria’s economies and

disrupted supply chains (CBN, 2020). A credit facility of N50 billion (about US\$136.6 million) was created to support households and small and medium enterprises (SMEs) that have been particularly hit by COVID-19. Central Bank of Nigeria further extended a moratorium on all CBN intervention facilities by one year on all principal repayment with effect from March 1, 2020 (CBN, 2020). Nigeria further requested emergency financial assistance of US\$3.4 billion from the International Monetary Fund to provide critical support for the healthcare sector, and shield jobs and businesses from the shock COVID-19 crisis (IMF, 2020). These government actions are testimonies of the impact of the COVID-19 pandemic on food systems and supply value chains.

Impact of Covid-19 on Food Security

An in-depth interview conducted with the six key informants summed their responses, thus: “Nigeria has faced food insecurity challenges during COVID-19 pandemic, “as no movement, no trading or businesses resulting in lack of income to eat well” (IDI, April 4, 2021). This was the overall assessment of six participants interviewed in the study and validated by documentary evidence in the Federal Ministry of Agriculture and Rural Development Report (FMARD) (2016)

Records analyzed revealed that with the COVID-19 pandemic, the challenges hampering the attainment of food security in Nigeria deepened. The impacts are already being felt in the form of rising food prices. As of April 2020, food inflation rose to 15% compared to 14.7% in December 2019 (NBS, 2020). Government intervention programs are the consequences of COVID-19 lockdown measures, and restriction of movements resulted in widespread unemployment and loss of income to poor peasant farmers and other businesses, especially those in hospitality, travel, tourism, aviation, small-scale business, agro-business, and supply chains (UN, 2020). The outcomes are diverse, household food insecurity, high prices of local food, hunger, poverty, and malnutrition among poor farmers and low-income earners. In the face of a drastic decline in income, poor farmers in rural communities, self-employed businesses, vulnerable households, rural and urban poor, and women quickly gave up nutrient-rich foods, resulting in hunger and malnutrition. For example, from a panel survey conducted, lockdown measures increased households’ experience of food insecurity by 12 percentage points and reduced non-farm activities by 13 percentage points (IFPRI, 2020). In addition, the relatively poor performance of the agricultural sector in Nigeria resulted in rising imports of food to cater to the needs of the growing population of the nation (CBN, 2020). This is a serious food security problem. In addition, the Consumer Price Index on food prices in Nigeria showed that food prices increased by 1.18% from March 2020 to April 2020, especially the increases in prices of potatoes, yam, and other tubers, bread and cereals, fish, oils, and fats, meat, fruits, and vegetables. The average annual rate of change between April

2019 and April 2020 is 14.22% (NBS, 2020). These were indicators of the impact of the COVID-19 pandemic on food insecurity.

DISCUSSION OF RESULTS

The impacts of the COVID-19 pandemic on the agricultural environment and its public policy implications on the environment, food systems, and food security in Nigeria have been revealed in this study. The agricultural environment as a focus of public policy has grown out of past experiences, but its major developments extend into the future. Public policy is becoming a critical factor in shaping environmental problems. Previous studies on human ecology, international law, public health, natural resources management, urbanization, and development planning have shown that there is a growing tendency to rely on the environment as a new focus of public policies (Easton, 1964).

The social and material pressures toward solving environmental problems on agriculture production, particularly with global actions on climate change, wilderness, technology development, organic chemicals, biodiversity, reduction of fossil fuel emission, energy consumption, and human activities, that affect food security have been exacerbated by the emergence of COVID-19 pandemic, as the farming season has been altered by the lockdown and social movement restrictions (FAO, 2020).

On food systems and food security, the COVID-19 pandemic exacerbated food insecurity that existed in Nigeria. It affected food price volatility in local and international markets and threaten the food security and nutrition of a large population of Nigerians. The COVID-19 pandemic exacerbated existing mass unemployment, food insecurity, poverty, hunger, malnutrition, poverty, and inequality in labor participation in businesses, rural farmers, urban poor, and vulnerable groups. These findings were supported by United Nations report (UN, 2020).

Moreover, the political, social, and economic activities suffered. Because of the COVID-19 lockdown, social restrictions, and border closures occasioned by government mitigation measures, many businesses, schools, hospitality industries, aviation, hotels, travel, trade, and self-employed businesses have been closed leading to losses in incomes and unemployment. The levels of poverty and inequality increased between the rich and the poor. The previous study on these issues supports the investigation of the impacts of COVID-19 on Political, social, economic, and agricultural value chains in Nigeria (ILO, 2020).

The levels of poverty and inequality between the rich and the poor also increased. According to the Nigerian Living Standards Survey (NLSS, 2020), before the COVID-19 pandemic, 40.1 percent of the total population was classified as poor. In other words, on average 4 out of 10 individuals in Nigeria have real per capita expenditures below 137,430 Naira per year. This translates to over 82.9 million Nigerians who are considered poor by national standards (NBS, 2019). The survey

indicates also that the rate of poverty in the rural areas is 52 percent, compared to Nigeria's 40 percent and urban dwellers 18 percent. Similarly, the rate of inequality measured in the Gini coefficient was 33 percent in rural areas compared to 32 per in urban and 35 percent in Nigeria (NBS, 2019). These were the conditions of the poor in the urban and rural areas before the COVID-19 pandemic in Nigeria.

During COVID-19, World Bank (2020) gathered data through a phone survey of 15,000 households in rural and urban Nigeria to understand how households and firms are dealing with incomes and food security during COVID-19 pandemic. The report showed that 70 percent of both urban and rural respondents experience a reduction in income since the onset of the COVID-19 pandemic. Moreover, the share of households whose income remained the same is much, smaller in rural areas than in urban ones, suggesting greater income volatility in rural areas (World Bank, 2020).

According to the World Bank (2020), this trend could be due to the reliance of rural households on the flow of remittances from their families in urban areas. Besides, as people lose their jobs in urban areas, the loss of income was felt by their families. Furthermore, rural households tend to rely on selling high-value perishable items both in urban areas and informally across borders. Restrictions on transportation, restaurant closures, and border shutdowns were affecting the incomes of rural households. The report further noted that more than 7.4% of respondents were facing food insecurity and 72% facing food insecurity in Nigeria (World Bank, 2020).

Rural girls and women, who are employed in the informal economy and contributing to the family workforce lost their incomes during the COVID-19 pandemic lockdown measures. In Nigeria, the COVID-19 pandemic impacted already existing gender inequality that favors men as against women, especially in their participation in small-scale farming labor force and supply value chains (NBS, 2020). This exacerbated the conditions of women in terms of gender equality and exposed them to undue pressure in household activities and essential services. Women often work as primary caregivers (social workers) in nongovernmental organizations and frontline health workers and support their husbands in rural areas in agricultural food processing and distribution (NBS, 2020). The pressure to manage limited family incomes as a result of lockdown measures affecting agricultural production activities, prevailed on them to prepare foods that lack nutrients that would boost nutrition and, therefore, substituted balanced diets with high-caloric foods, leading to malnutrition in their children (UN, 2020; FAO, 2020; NBS, 2020).

Moreover, with the emergence of COVID-19, the conditions of unskilled workers, home-based entrepreneurs, and the poor in rural and urban areas were exacerbated. Poor people spent more than half of their incomes on food, and their ability to purchase food was severely hampered by the loss of income streams, leading to a decline in dietary quality due to income inequality (NBS, 2020). Rural youths who are normally employed in the informal economy and contributing to the family

workforce also lost their incomes during the lockdown measures, Moreover, migrant and seasonal workers, who harvest food and agriculture products, were locked out of business by internal restrictions and external border closure (FAO,2020). This resulted in this category of vulnerable groups moving into more destitution, hunger, and malnutrition, exacerbating existing poverty and inequality in Nigeria.

CONCLUSION AND POLICY IMPLICATIONS

From the analysis undertaken in this study, the results have shown that the COVID-19 pandemic exacerbated the challenges existing in the agricultural environment, food systems, and food insecurity, thereby, increasing the level of poverty and inequality in Nigeria. So, the investigation of this specific agricultural environmental problem, such as COVID-19 is essential to any larger or more generalized concept of the agricultural environment. Adopting an integrated systematic approach as the framework of analysis to analyze the impact of the COVID-19 on agriculture, the food system, and food security is a significant contribution to the literature, because it provided an understanding of the patterns of relationship existing between agriculture, food systems and sustainable food security in Nigeria. These patterns of relationship are supported by the United Nations Report on the impact of COVID-19 Pandemic on agriculture, food system, and food security (UN, 2020). However, this study suggests that these patterns of relationship on the impact of COVID-19 Pandemic on agriculture, food systems, and sustainable food security in Nigeria should be confirmed in the future using quantitative or mixed-method research.

The implications of the impact of COVID-19 pandemic on agriculture, food system, and sustainable food security call for concerted policy actions on the agricultural environment, food systems, and food security in Nigeria.

Climate-smart agriculture and green architecture in building designs that make a wide variety of much smaller demands on the environment should be pursued to fight climate change. Resilience to climate change can be achieved through water and energy-saving irrigation, conservation agriculture and controlled environment farming, livestock grazing management, energy-efficient cold storage, biogas production, and renewable energy. Biotechnology or genetically modified organisms or genetically engineered crops should be adopted to promote agriculture productivity gains and combat food insecurity in the face of the COVID-19 pandemic spillover.

(1) Introducing new Agricultural Policy

Agriculture policies in Nigeria have not helped much to promote and sustain food security in Nigeria. Government policies have completely subverted the normal functioning of the price system. Four types of agricultural policies are involved

- (i) subsidies for specific farming inputs such as equipment, fertilizers, and pesticides

- (ii) guaranteed prices for outputs,
- (iii) marketing loans based on crop prices, and
- (iv) trade barriers to protect against competition from imports

Agricultural subsidies have helped to create a dependence on purchased inputs. These types of policies cannot enhance agricultural productivity increase and sustain food security in Nigeria. This study, therefore, recommends the following policy options for agricultural productivity increases and sustainable food security in Nigeria:

(2) Sustainable Food Security Policy

It is important that the Nigerian government put in place measures to strengthen local food production and supply and in turn moderate the cost of food. There is a need to embark on land reform. Lands are not “titled, effectively nullifying their capacity to be treated as collateral for financial transactions” (Ogbeh, 2016, 26). Government should amend the current Land use Act to encourage access to land. There should be access to market information in non-markets and innovations through access to information and knowledge

Moreover, the government should ensure that it expands strategic food reserves to make food available at short notice during periods of unexpected scarcity and for stabilizing food prices, as well as provide food during periods of emergency due to civic strife or natural disasters, like COVID-19 pandemic. The policy should enhance the quality of foods by proper use of agrochemicals quality control and testing to avert pests and diseases. Government should also encourage effective fertilizer use through soil mapping as policy thrust for soil fertility. This can be achieved by the passage of pending fertilizer and seed bills in the National Assembly. It should also encourage continued expansion of organic farming and the sale of the freshest foods domestically and internationally. In addition, government should have better-developed processing and storage facilities through better storage.

(3) Institutional Synergy and collaboration between Federal, State, and Local governments in implementing Food Security Policies

The federal government should partner with state governments to incentivize agribusiness development, including safeguards for small-holders rapid/collateralization of land and focused infrastructure access. This can be achieved by providing rural infrastructure, roads, water, electricity, and others. There should be harmonization of standards, quality, and other food safety measures for food security, market, and trade.

Though the two tiers of government – Federal and State have authority over agriculture, collaboration has not always been smooth, nor desirable results generated. There has been apathy in states for key programs driven by federal government and a history of non-involvement of local governments in policy implementation due to

implicit control issues abound. To ensure full utilization of potentials, Federal, State, and Local governments should focus on greater collaboration, implementing policies jointly approved at the National Council on Agriculture. The three parties should set up a mechanism to remove conflict areas and focus squarely on implementation. Federal–state dialogue should be improved to enable them to leverage and engage other investors and improve levels of communication in the agricultural business economy.

(4) Food infrastructure programmed

Food infrastructure in rural communities needs an infrastructure program that would support food production, security, and rural development. Rural development relates to the need, as a responsibility of the government to reduce poverty in rural areas, alleviating the suffering of rural dwellers and creating enablement for economic trade-offs in the rural areas. Government should promote economic activities in rural communities, develop rural infrastructure, and improve the enabling environment for food infrastructure programs' investment and opportunities.

(5) Research and innovation

Finally, agricultural research is recognized as a critical enabler of economic growth. The importance of agricultural research toward national food security, import substitution, and job creation cannot be over-emphasized. Smart agriculture was sponsored by United Nations Food and Agriculture Organization as a technique approved to develop technical policy and investment conditions to achieve sustainable agricultural development for food security under climate change. This entails:

- sustainably increasing agricultural productivity and incomes;
- adapting and building resilience to climate change and
- reducing and/or removing greenhouse gases emissions, where possible

Nigeria has not been able to implement climate-smart agriculture. Nigeria's agricultural research has to contend with the need to become climate smart to promote agricultural productivity and sustain food security in Nigeria.

Climate-smart agriculture and green architecture in building designs that make a wide variety of much smaller demands on the environment should be pursued to fight climate change. Resilience to climate change can be achieved through water and energy-saving irrigation, conservation agriculture and controlled environment farming, livestock grazing management, energy-efficient cold storage, biogas production, and renewable energy. Biotechnology or genetically modified organisms or genetically engineered crops should be adopted to promote agriculture productivity gains and combat food insecurity in the face of the COVID-19 pandemic spillover.

Moreover, there is inadequate and irregular funding for agricultural research and extension services in Nigeria. Research outputs are not demand-driven. The research–extension linkage system is weak, so the technologies or innovations generated are not effectively delivered to farmers or commercialized for the benefit of end users. Government should expand the research community’s capacity to leverage digital innovations to lower the costs of fieldwork. Agricultural institutions should conduct research for increased agricultural productivity and make the research results available to farmers and other actions in the agricultural development of the states.

COMPETING INTEREST

No conflict of interest was declared.

AUTHOR CONTRIBUTION

The author is Dr. Augustine Nduka Eneanya, an Associate Professor, Department of Political Science, Faculty of Social Sciences, University of Lagos, Akoka, Yaba, Lagos, Nigeria. The author conceived, conducted, and wrote the entire research

DISCLAIMER

The views expressed in this article are entirely that of the author and not that of University of Lagos, Akoka, Yaba Lagos, Nigeria.

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