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GOVERNMENT STRATEGIES FOR GREENHOUSE INITIATIVE AND THE CHALLENGES OF AVAILABILITY, ACCESSIBILITY, AFFORDABILITY AND SUSTAINABILITY OF FOOD IN PLATEAU STATE, 2015-2023

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Abstract

Several measures have been put in place by Plateau State Government to promote greenhouse agriculture in the state. Yet, challenges still exist which have made it difficult to achieve impressive levels of success, going by records available. This study therefore examines government strategies for greenhouse initiative and the challenges of availability, accessibility, affordability and sustainability of food in plateau state from 2015-2023. Production theory was employed as framework of analysis. The theory concerns itself with the economic process that describes how certain specific inputs are jointly combined to produce a given level of output. Primary and secondary methods of data collection were utilized; primary data were collected using structured questionnaire, desk reviews conducted across government agriculture institutions such as PADP, FADAMA III etc and Key Informant Interviews (KIIs). The population of the study is 6,656 while using Krejcie and Morgan formular; sample size is 384. The study reveals that prior state investments partnership with Agricultural Services Training Company and Marketing (ASTC&M) in 2008

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boost greenhouse farming technology, marketing of farm produce and improving food security in the state. The establishment of Agro Climate Resilience, in Semi-Arid Landscape (ACReSAL) in July, 2023 continue to support the implementation of greenhouse technological in the state. Finding also reveals that demand for food exceeds the supply of food because the rate of growth of population is higher than the growth in agricultural productivity. Also, the large population continues to relocate to the urban areas in search of white-collar jobs which in most cases do not exist. This youth rural-urban drift makes it difficult for the state to be food secured. Flood, leaching cause by many years of mining activities, urbanization using Jos-master plan are some of the environmental issues affecting food security in the state and by extension, Nigeria. The study thus recommend increase synergies and collaborations among farmers, greenhouse policy development and research institutes facilitating appropriate policies with actionable targets at the local, subnational and national levels for short and long-term. This will strengthen greenhouse initiative and combat the impact of population, urban drift, leaching and climate change on food security.

Introduction

The main goal of food security is for individuals to be able to obtain nutritionally balance food needed at all times, and to be able to utilize the food to meet the body's needs. The World Bank (2020) identifies some pillars underpinning food security. These are food availability, food accessibility, food affordability, and food sustainability. This means that a nation whose food production level is unable to satisfy these four criteria is said to be food insecure. Food security is a critical issue facing communities globally, particularly in developing countries. According to the Food and Agriculture Organization (FAO) of the United Nations (2024), around 820 million people worldwide suffer from chronic undernourishment, and 2 billion people lack access to safe, nutritious, and sufficient food to meet their dietary needs. However, despite the various concerns by governments all over the world on ensuring that every household can at least provide three square meals, food insecurity has continued to be a major problem of development across the globe, thus undermining people's health, productivity, and often their very survival.

African nations have been experiencing severe food and nutrition insecurity issues, with more than 23 million people needing food relief to survive. In addition, it is anticipated that nearly 33.4 million individuals will experience a worse situation, such as hunger and malnutrition, owing to the food security challenges African economies face. This situation has worsened due to unexpected problems such as the Ukraine and Russia wars, political

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unrest and ecological destruction experienced by the African countries (Segbefiaa, Daib, Adoteya and Sampenec, 2023).

Nigeria's population is growing at a very alarming rate. According to Worldometer (2023), Nigeria's population increased by 14.68% from 2015 (from 181,137,448 in 2015 to 227.9 million in 2023). The population is estimated to increase by 26.61% by 2030 and 93.19% by 2050. Demand for food will increase with this drastic population growth. The urban population grew from 47.8% in 2015 to 52.0% in 2020, representing a drift from rural settlements and farming. Urbanization leads to infrastructural development and increases income. However, it also increases the demand for processed food. Over the years, the movement of rural populace to urban areas as a result of insecurity of lives and farms has been on the increase giving rise to urbanization and a subsequent disruption of the ecosystem that heightens the demand for food security. As a result of these, people now reside in habitat that includes large cities, towns and major urban metropolis. These urban population are particularly vulnerable to fluctuations in food prices because food (often over 60 percent) makes up a large part of household expenses (Abur, 2024).

In 2008, Agricultural Services Training Company and Marketing (ASTC&M), in partnership with the state government expanded investment in smart greenhouse in Plateau State utilizing advanced technologies such as automated climate control, hydroponics, the pilot project further deepened the potential of controlled-environment agriculture in a region plagued by unpredictable weather patterns and soil degradation. The initiative built by the Plateau State (ASTC&M), Project in Vom is known as Greenhouse Farm. The initiative also aimed to improve food production with specific attention on nutritionally balance vegetables, farmer livelihoods and reduce poverty and contributing to the overall economic development of the State. The success of the initial greenhouse sparked interest among local farmers, within and outside the state, civil servants, retirees and both local and foreign investors, leading to the establishment of additional greenhouses across the state and beyond. Today, the state especially boasts of over thousands of smart greenhouses, each equipped with cutting-edge technology that optimizes plant growth while minimizing resource use (Achike and Onoja, 2024).

According to National Bureau of Statistics (NBS), 2022 Multidimensional Poverty Index (MPI), Plateau State was placed 6th amongst the 36 States and Federal Capital Territory (FCT), Nigeria. Food insecurity is considered a significant factor in the above analysis with over 40% of the population living below the poverty line (National Bureau of Statistics, 2024). However, with the soaring poverty, low agricultural productivity, inade quate infrastructure and population of over 4 million people contributing to the problem, solution seems to be far reaching. Over the years, the state is known for its agricultural products such as potatoes, maize, and yams (Plateau State Government, 2021). Its natural soil, quality and temperate weather condition also support the cultivation and growth of

assorted exotic vegetables like bell-peppers, curly flower, broccoli, kyle, asparagus, tomatoes, cabbage, purple cabbage, radish, cauliflower, celery, carrot, cucumber, strawberry, spinach, lettuce others are potatoes, apples, grapes, wheat, barley and etc.

According to NBS, farming has been an age long inherited affair with more than 50% of the farming population practising subsistence farming exposed to the traditional systems, with less than 5% practising modern farming. This saw majority of the farmers on the Plateau desirous of adopting modern systems of farming. Data collected from the Plateau Agriculture Development Programme (PADP),Monitoring and Evaluation (M&E) Department, shows that from 2010 to 2023, major crops production such as Maize, Groundnuts, Irish potatoes, tomatoes, carrots, cabbage, okro and pepper stood at over 81,152.53 Mt.T of total estimated food production in the state: Maize accounted for 4,594.85 Mt.T that is 5.55%;Groundnuts and Irish potatoes (root crops) 35,773.26 Mt.T that is 44.08%; while vegetables (tomatoes, carrots, cabbage, okro and pepper) put together accounted for 40,784.42 Mt.t that is 50.23% of the total food produced in Plateau state. This shows the state produces more vegetables compare to other food categories like cereals and root crops and has the potentials to grow more. Between 2010 to 2023 food production increased exponentially from 1,775.94 Mt.t to 6,218.96Mt.t.

Critical stakeholders like "The Acting Now programme" in Nigeria offer smallholder farmers training and financial support, and plant disease-resistant potato seedlings that enable them to boost their harvests and incomes. In another effort Oxfam, Nigeria in partnership with COCIN Community Development Project (CCDP) a faith-based organization, established four clusters of twenty-five members each as Urban Food Crews (UFC), in Jos-North and Jos-South Local Government Areas (LGAs). Aimed at building an inclusive food system within the urban setting where everyone would have access to nourishing foods within the value chains that offers enterprise opportunities for women and young people. A Jos Organic Farmers' Market was established in June, 2025 to serve as one-stop-shop of food system hub promoting quality production, efficiency, profitability, and environmentally friendly functional food systems.

Despite the efforts of the Nigerian Government and International Organizations to address food security challenges, there is lack of comprehensive study to ascertain the contribution of greenhouse initiative to nutritionally balance vegetables production in Plateau State. This knowledge gap is significant as it hinders the formulation of evidence-based policies to improve food security in the state. It is against this background that this study examines strategies used by Plateau State government to support greenhouse initiative and the challenges of availability, accessibility, affordability and sustainability of food in Plateau State from 2015-2023.

Objectives of the Study

i. Assess the strategies used by Plateau State government to support greenhouse initiative in contributing to availability, accessibility, affordability and sustainability of food in Plateau State.
ii. Examine the extent to which the factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in Plateau State.

Strategies used by Government to Support Greenhouse Initiative in Contributing to Availability, Accessibility, Affordability and sustainability of Food

Ibrahim, Gajere, Dang, Jerome, Dashan, Mwadaand Ojih (2020) conducted a study on Geospatial Tools for Suitable Assessment of Small Holder Irrigation Water, towards Increased Food Production and Poverty Eradication in Nigeria: A Case of Jos East LGA. Plateau State. The research explored geo-information methods to map, select and quantify suitable areas to site reservoirs for sustainable Small Holder Irrigation in Jos East LGA of Plateau state as a case study. Spatial Multi Criteria Analysis (SMCA) and other quantitative tools were employed for the spatial modeling and subsequent analysis. The results revealed that 11 sites are highly suitable in Jos East. Volumetric analysis was carried out to estimate potential water collection capabilities of these reservoirs, and the water prospect is estimated between ~172,660 m3 to ~13,929,275 m3, this was based on the calculated depth, and surface area of the prospective reservoirs. Subsequently, the study noted that this model can be replicated in other parts of Plateau state, Nigeria and Africa with similar environmental, climatic conditions and water demands.

The study established that irrigation is very crucial for sustaining global food security and poverty reduction, especially during off season food production in developing countries. That is why there is need to identify potential water reservoirs and its production at peak dry seasons. Plateau state in recent years is exploring extensive irrigation schemes to meet up overwhelming national demands of exotic temperate crops and vegetables. The local farmers rely on seasonal streams and abandoned mine ponds for irrigating their crops, but water in these sources are exhausted easily, leading to increased yield losses. The study proposed small reservoirs with simple engineering techniques to serve poor local communities in developing countries, which can alleviate poverty and enhance sustainable agricultural production. The initiative is in line with FAO's and World Bank's programmes and recommendations, and which can promote pragmatic solutions and guide project allocations in line with Sustainable Development Goals (SDGs). The suggestions made do not reflect strategies used by Plateau State government to support greenhouse initiative can contribute to availability and accessibility of food in the state. Nutritional Society (20230, assert that water constitute 92g out of 100g serving of bell

peppers, and cucumbers. Others can be at different ratios. That brings to mind the importance of water in greenhouse food production.

Olanrewaju-Elufowoju and Lawrence (2024) examined the implementation of the Climate Change Act 2021 and other legal regimes in combating the effects of climate change with a view to achieving food security in Nigeria. Using primary and secondary sources of laws, the study employed doctrinal legal approach. It found that the major problem in effectively solving the challenges posed by man induced climate change is in weak legislation and poor implementation. It recommended that to enhance effectiveness, the government prioritizes enforcing climate change regulations and developing institutional capacity for enforcement. It concluded that to attain a maximum level of food security in Nigeria, the law must ensure the implementation of its climate change obligations to maintain environmental protection from the harmful impact of change climate. While the study highlighted the lapses evident in the implementation of the laws and policies for combating climate change, it did not include the strategies used by Plateau State government to support greenhouse initiative in contributing to availability and accessibility of food in the State which is an area of focus in this study. In some instances, across the state, individuals' farmers within a given communities are seen organizing themselves into small groups for self-help with no government attention.

Factors Hindering Greenhouse Initiative and its effect on the Availability, Accessibility, Affordability and sustainability of Food

Gershon and Mbajekwe (2020) examined the relationship between climate change and agricultural production (crop and livestock) in Nigeria using time series data from 1981-2017. Variables used to depict climate change are mean annual rainfall, temperature and carbon dioxide emissions. Data on crop yield were collated for 17 major crops produced in Nigeria with the livestock production index of Nigeria. Econometric analysis was carried out using autoregressive distributed lag (ARDL). The results showed that there is a long run relationship between climate change and crop production while no long run relationship exists between climate change and livestock production. Furthermore, evidence is provided that rainfall and CO2 emissions have a positive and significant effect on crop yield in the long run while temperature has a negative and significant effect on crop yield in the long run.

The study has contributed to literature in two ways: firstly, it employs aggregate output of 17 crops mainly produced in Nigeria - cassava, cocoa, groundnuts, kolanut, maize, melon, millet, oil palm, plantain, rice, rubber, sorghum, soybeans, yam, cashew, sesame and potatoes. As such, it offers a more representative sample of aggregate crop production in Nigeria. Secondly, the study uses the livestock productivity index to ascertain the effect of climate change on Nigeria's agricultural sectors. Thereby, it has

uniquely highlighted an underlying factor (climate change), previously acknowledged in Nigeria's farmers-herders clashes which has claimed many lives. This study was limited by lack of data on the emissions of other greenhouse gases to answer the extent which the factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in Plateau State. Elements such as security of farms and farming communities, skills and availability of improved seeds were not considered as likely impediments to realizing optimum harvest and affecting the volume of Co2 produced.

Olayide (2021) studied Nigeria - land, climate, energy, agriculture and development: A study in the Sudano-Sahel Initiative for regional development, jobs, and food security, The methodology employed in the review involved searching keywords related to the study objectives on relevant literature search engines and platforms, including Google Scholar and Cross Referencing through triangulation of search results. Based on the assessment of literature in the study, the key trends and problems include inadequate attention to the agricultural sector over the years, which have caused a major setback in food security and productivity. Climate change has further exacerbated the problem through desertification, drought and flooding across the country.

The literature further revealed inadequate energy supply, distribution and low per capita consumption in Nigeria. The use of fuel wood for heating and cooking has significantly contributed to deforestation by worsening land degradation. Resulting implications are that food security is threatened and economic growth is hampered. Land degradation negatively impacts the environment and the rural poor whose livelihoods solely depend on it. Therefore, there is need for productive, viable, sustainable policy and programmes that support climate change mitigation, land use, energy and sustainable development in Nigeria. The study is a regional study and to avoid error of generalization, there is need for further investigation in examining the extent which the factors hindering greenhouse initiative affect the availability accessibility, affordability and sustainability of food in Plateau State. One would be quick to posit that; low per capita income over time has severe consequences on food security when individuals are psychologically, socially and emotionally imbalance to initiate any alternative productive means of livelihood especially the greenhouse. On the other hand, skills required for a minimum greenhouse operation would require a minimum level of academic knowledge to read basic instructions on how to manage the farm especially, what is usually written on most of the farm inputs indicating quantity, when, how and where an element is needed. This goes a long way to determine the overall yield and the nutritional value.

Theoretical Framework

The study chooses production theory as its framework for analysis. The theory (production) was propounded by Baumol (1977). The theory concerns itself with the

economic process that describes how certain specific inputs are jointly combined to produce a given level of output. The production theory has its footing in the works of the neoclassical economists. The neo-classicals argued that the economy comprises of two important agents – the consumer and producer. The former engages in consumption activities whilst the latter undertakes production activities. These decisions or activities taken by the aforementioned agents are considered inseparable owing to the fact that the decision bothering on consumption, labor supply, and production are looked at simultaneously through the behavioral lens of three key agents: consumers, workers, and producers (Mankiw, 2024).

Production economics is concerned with optimization of resources and optimization implies efficiency (Baumol, 1977). Production is concerned with the relative performance of the process used in transforming input into output. The analysis of efficiency is generally associated with the possibility of farms producing a certain optimal level of output from a given bundle of resources or certain level of output at "least cost". Farrel (1977) distinguishes between three types of efficiency: (a) technical efficiency (TE), (b) allocative or price efficiency (AE), and (c) economic efficiency (EE).

The relevance of the theory to the study is that it provides explanation for the success and failure of a production firm in Nigeria. It emphasized that the level of technical efficiency of a particular firm is characterized by the relationship between observed production and some ideal or potential production. It went further to explain that the measurement of firm specific technical efficiency is based upon deviation of observed output from the best production or efficient production frontier. If a firm's actual production point lies on the frontier, then the firm is said to be perfectly efficient in the use of the production inputs.

Methodology

This study adopts mixed research design. This design incorporates both techniques of quantitative and qualitative data collection and analysis. The target population is comprised of Plateau State Greenhouse Farmers Association, Ministry of Agriculture and Rural Development Plateau State, Agricultural Services, Training Centre and Marketing (ASTC and M), Plateau State, Plateau State Agricultural Development Programme (PADP) and FADAMA III Programme.Hence the population of the study is 6,656.

Table 1: Sample Frame Showing Population of the Study

S/N	Focused Institutions	Population
1	Plateau State Greenhouse Farmers Association.	2,857
2	Ministry of Agriculture and Rural Development Plateau State	233

3	Agricultural Services, Training Centre and Marketing (ASTC and M), Plateau State	307
4	Plateau State Agricultural Development Programme (PADP)	2,070
5	FADAMA III Programme	1,179
6	Three Star Hotels in Jos City (end Users)	10
	Total	**6,656**

Source: Author's Compilation, January, 2024.

The population of the study (6,656) is deemed to be large; and the researcher opted to make use of the sample rather than make use of the entire population. The statistical tool of Krejcie and Morgan (1970) statistical was used to determine the sample size to 384.
The study made use of both primary and secondary methods of data collection. The instruments that were used in collecting data for this study are oral interview, questionnaire and secondary sources such as desk reviews. The application of these instruments helped the researcher have access to firsthand information about the greenhouse initiative and food security in Plateau State. Stratified and random sampling techniques were used in selecting the respondents among different categories of staff selected for the study. Purposive sampling technique was used for the selection of respondents for interviews. This technique was chosen because it enables the researcher to purposely choose respondents at their locations. The sample comprised of people with many similar characteristics such as deep knowledge on the subject of investigation, years of experience and age. This study made use of descriptive statistics with the aid of tables and graphs as a platform to present the research data and also analyze the data that were collected from the field on the subject matter using simple percentages and tables as the case may be for the descriptive analysis. The version that was used for analyzing data for the study is SPSS 25. Content analysis was used to analyze qualitative information.

Data Analysis and Interpretation of Results

Three hundred and eighty – four (384) copies of questionnaire were administered while three hundred and seventy (370) copies of questionnaire were duly completed and retrieved. Fourteen (14) copies of questionnaire were not retrieved and all efforts to retrieve them proved abortive as some literate respondents insisted to fill the questionnaire themselves and were not easy to manage. Therefore, the presentation and analysis were done based on the 370 retrieved copies of questionnaire. The pattern of presentation was based on the objectives of the study using frequency table (frequency, count and percentage). The discussion of findings which include desk reviews then followed. Interviews were equally held with members of the public. The interview results were supplemented with information from the extant literature, including newspapers, reports, and official documents.

Table 2: Responses on the strategies used by Plateau State government to support greenhouse initiative in contributing to availability, accessibility, affordability and sustainability of food in Plateau State

Responses	Frequency	%
Climate-smart agriculture	89	**24**
Training and sharing of starter packs (money) to the poor and vulnerable groups	106	**29**
Provision of seedlings to boost harvests and incomes	113	**30**
Provision of infrastructure	62	**17**
Total	**370**	**100**

Source: Field Work, September (2025).

Table 2's question seeks to understand the strategies used by Plateau State government to support greenhouse initiative in contributing to availability, accessibility, affordability and sustainability of food in Plateau State. Statistically 89; 24% suggest climate-smart agriculture, 106; 29% indicated Training and sharing of starter packs (money) to the poor and vulnerable groups, 113; 30% indicated provision of seedlings to boost harvests and incomes, while 62; 17% indicated provision of infrastructure. This agrees with proposition three that states that climate-smart agriculture, training and sharing of money to the poor and vulnerable groups and individuals seems to be the major strategies used by Plateau State government to support greenhouse initiative in contributing to availability, accessibility, affordability and sustainability of food in the State. This is supported by the following information from both interview and secondary sources:

> Plateau State is aiming to revitalize its agricultural sector through the implementation of a Special Agro Processing Zone. This comprehensive approach includes focus on both livestock and crop production, development of processing facilities to add value to agricultural products, and improvement of energy infrastructure to support agricultural activities. By creating this specialized zone, Plateau State is not only boosting primary agricultural production but also fostering the growth of agro-processing industries. This integrated approach has the potential to create a thriving agricultural ecosystem that generates employment and drives economic growth. The Plateau Government, through the Agro Climate Resilience, in Semi-Arid Landscape (ACReSAL), has taken steps to boost agriculture in the state using greenhouse farming technology. The Plateau State Government launched an agricultural programme aimed at enhancing the marketing of farm produce and improving food security in the State (Victor Basil - Field Agronomist & Marketing officer at Agricare, September, 2025).

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Plateau State Government, investment in greenhouse farming in the recent times across the communities in the three senatorial zones of the state in line with the 'Acting now agricultural programme' is meant to enhance food resilience for thousands of households in the State. The programme offers smallholder farmers training and financial support, and plant disease-resistant vegetables seedlings that enable them to boost their harvests and incomes. Smallholder farmers in the Acting Now programme are on a transformative journey to greater food security through practical training, financial resources and new seed varieties to reinvigorate their farms. As part of the programme, *Solidaridad* selected 32 farms to serve as demonstration sites that provide a practical learning location and a vital source for high-quality seeds and seedlings. Farmers at these 32 sites received and then planted over 1,500 kilograms of seven different disease-resistant varieties of potato seeds adapted to the local environment. The seeds were planted in November 2023 and carefully irrigated to encourage germination to ensure the seedlings were ready for the upcoming farming season (Punch, 2025).

After three months, the participants at the demonstration farms harvested a total of 3,227 kg of potato seedlings from the demonstration farms. This has boosted the farmers' confidence, and some are now growing and selling seedlings to other farmers within their communities. With a steady supply of quality seedlings, it has now become an achievable goal to grow food throughout the year. The harvested seedlings were then distributed to other participating farmers as part of the Farmers' Inputs Delivery and Investment Scheme (FIDIS). The FIDIS operates on a credit system through Community Farmer Groups (CFGs), which enable farmers to procure quality seeds upfront and then repay the loan at a later date. The repaid funds are then channeled back into the CFGs to facilitate the procurement and distribution of inputs during planting seasons.

> Supporting smallholder farmers with potato seeds and encouraging their investment not only benefits the farmers, but also contributes to broader agricultural development goals, including poverty alleviation, resilient local food systems, enhanced input delivery, food security, and sustainable rural development (Nancit Dandam - Dept. Dir. M&E, PADP, September, 2025).

Plateau State in 2008, under the administration Jonah Davis Jang, initiated Agricultural Services and Training Center and Marketing (ASTC&M) in partnership with Israeli Company aimed at revolutionizing agriculture. Government good intention suffered none continuity by his successor Dr. Simon Lalong whose perception towards Israeli Company was ill-conceived and politically stirred as security risk to the State. According to shared data from ASTC and M, before the intervention food production, especially vegetables was placed at less than 7% far below the State total capacity, faced with so many challenges of security, economic, social and knowledge gaps in the entire value chain.

Within the period 2009 –2015,vegetable productions in greenhouses in the State, increased only by 12% (far below the State potential) despite numerous interventions in greenhouse farming by Government and None-Governmental Organizations (NGOs) in supporting women, youths and farmers associations through funding, capacity building (land preparations, seeds selections, cultivations, farm management, harvest and post-harvest management, logistics and provide market linkages whereby farmers and off takers interface), provision of inputs and high improved seeds to ensure that food security is taken to a new height in the State yet, food security has become a huge challenge.

> Other schemes are installations of highly sensitive and remote devices such as launched satellites in the orbit for weather forecast to establish early warning information to prone farm areas, dictating infectious diseases cause by insects, fungi and rodents proffering possible solutions. It also includes soil analysis before and after cultivation to ascertain the Ph value and other nutritional constituents of a farm area. These are capital investments that can acquire through Direct Foreign Investments (DFI) or deliberate Government investments in research and development (Gideon Dandam - General Manager. FADAMA III, Plateau State September/2025).

Over the years the State is guided by the pre-independence, national policies and of course various agricultural reforms programmes of the Federal Government of Nigeria (FGN) which need to be reviewed. Crops grown within the State vary from assorted vegetables, grains or cereals, root crops and few mangrove vegetations found at the deep forest locations of the southern plateau and along the peripheries of Bokkos Local Government and Nasarawa state.

Table 3: Showing approved allocations and actual funds released for agriculture development programmes inPlateau State

YEAR	BUDGET ALLOCATION (N)	ACTUAL RELEASED (N)	REVENUE (N)	% OF FUNDS RELEASED
2009	4,092,727,000	1,610,333,350	1,005,547,830	39
2010	5,552,100,000	2,483,000,000	640,912,981	45
2011	3,523,340,000	801,000,000	893,310,481	23
2012	2,137,560,000	87,649,545	149,329,526	4
2013	1,821,203,373	1,186,479,444	117,933,174	65
2014	6,094,980,000	1,917,550,640	113,059,975	31
2015	2,488,480,000	717,520,214	106,572,092	29
2016	2,937,333,000	601,947,195	78,887,092	20
2017	6,107,183,000	3,056,450,000	177,877,342	50
2018	4,015,633,000	874,010,690	2,037,895,242	22
2019	2,674,850,000	135,000,000	312,719,242	5
2020	2,441,707,143	61,289,550	215,363,092	3
2021	5,202,982,977	161,004,000	2,404,934,429	3
2022	2,521,842,977	544,558,492	2,763,227,836	22
2023	2,905,175,438	28,356,900	2,804,601,836	1

Source: (National Bureau of Statistics, 2024).

Concern is more on the State capital investment in agriculture development programmes based on approved allocations and actual funds released within the period which shows significant allocations with insufficient release to the subsector table 2 refers. Whereas, positive changes in both funds released and revenues realized from 2009-2011 may be link to the State commitment to agriculture reforms programmes initiated by the government within the period. It also brings to bear that increased in the State revenues was an indication that farmers had improved productivity. From 2012-2015 funds were allocated particularly in 2014 and 2015 with substantial released which does not reflect on the revenues. Typical of electioneering period which economic programmes and activities usually decreases with most attention given to election funding. From 2016-2021 so much was allocated to the subsector with only 2017 and 2018 had released with no results in terms of revenue to justify released funds. This may be connected to the corona pandemic which collapsed world economies including Nigeria. State infrastructures were all rendered inefficient and ineffective. Individuals were only concern with how to survive.

Table 4: Distribution of Agricultural Interventions in Four Local Government Areas of Plateau State

LGA	Production (Irrigation)	Transportation and Storage	Processing & Marketing
Mangu	Small earth dam, wash bore, tube wells, water catchment, spring capture, water pumps	Access roads, diffuse light stores	Community market, processing unit
Bokkos	Small earth dam, wash bore, tube wells, water pumps, water catchment	Access roads, diffuse light stores	Community market, processing unit
B/Ladi	Small earth dam, wash bore, tube wells, water pumps, water catchment	Access roads, diffuse light stores	Community market, processing unit
Riyom	Tube wells, water catchment, spring capture, water pumps	Access roads, diffuse light stores	Community market

Source: Dakusuk, Erunke & Pius (2024).

Plateau State account for 95% of Nigeria's potatoes production and from Plateau, potatoes is exported to Ghana, Niger, Chad and other countries (Leadership, 2015). In 2014, African Development Bank (AfDB) came up with a comprehensive programme that will affect 100,000 farmers. It is expected to create 60,000 jobs in a potato value chain from processing, storage, replacement of current inputs and indeed, export (Plateau State Potato Value Chain Report, 2018). The potato value chain intervention is in line with

the African Development Bank (AfDB) group "HIGH 5" goals of light up and power Africa, feed Africa, industrialized Africa, integrate Africa and improve the quality of life for the people of Africa. It is also aligned with the Bank's Feed Africa – Strategy for Agricultural Transformation in Africa (2016 – 2025). The intervention will contribute to the four strategic goals of the African Agricultural Transformation Agenda which includes contribute to ending extreme poverty by 2025; end hunger and malnutrition by 2025; Turn Africa into Net Food, Exporter by 2025; and More Africa to the top of key global agricultural value chain by 2025.

Table 5: Responses on the extent which the factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in Plateau State

Responses	Frequency	%
a. Population increase	82	**22**
b. Environmental issues	71	**19**
c. Unstable government policy	63	**17**
d. Land degradation and desertification	42	**12**
e. Insecurity	112	**30**
Total	**370**	**100**

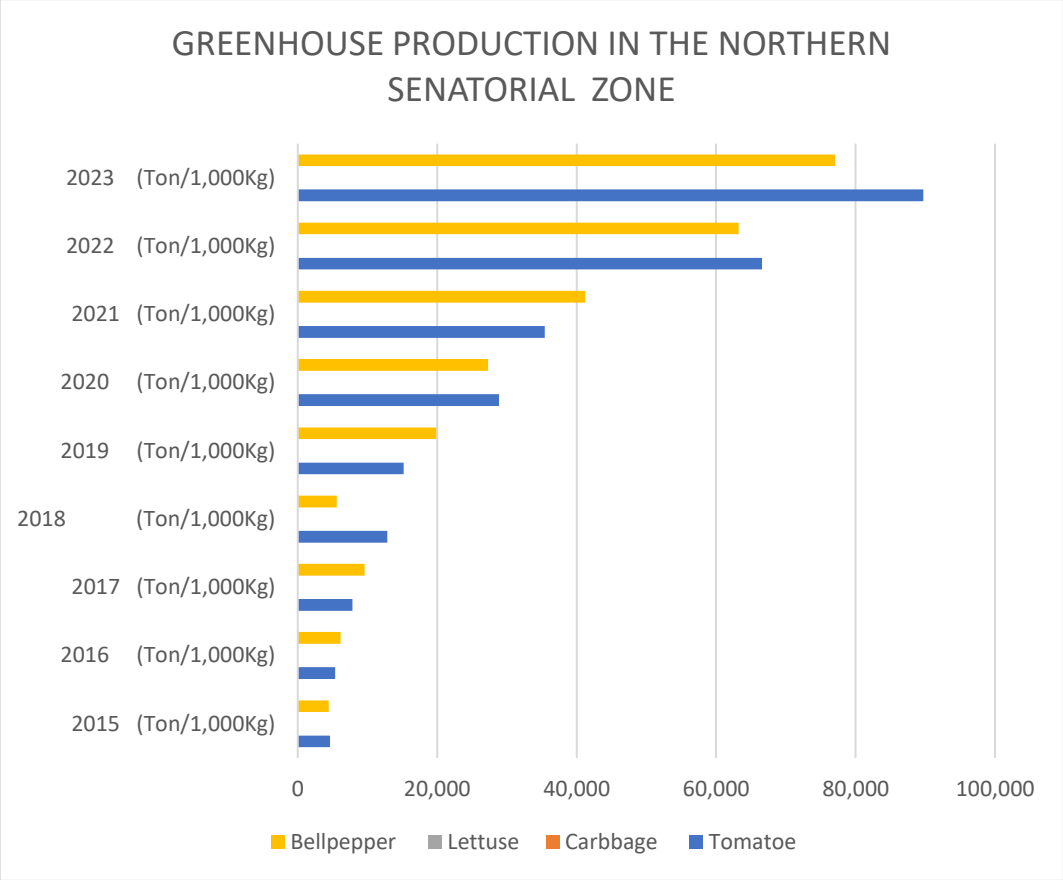
Source: Field Work, September (2025).

Table 5's question seeks to understand extent to which factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in Plateau State. Statistically 82; 22% suggest population increase, 71; 19% indicated environmental issues, 63; 17% indicated unstable government policy, 42; 12% indicated land degradation and desertification while 112 respondents accounting for 30% indicated insecurity as the extent which the factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in the State. This validates research proposition four with insecurity leading the rates though, others like population increase, environmental issues and unstable government policy on the other hand appears to be contributing to factors hindering greenhouse initiative and affecting the availability, accessibility, affordability and sustainability of food in the State. This is supported by the following information from both interview and secondary sources:

> Low agricultural productivity in recent decades due to a lack of investment in the agrifood sector has been a severe obstacle to value chain development. The productivity of agriculture is severely hampered by lack of quality inputs and a basic understanding of effective agricultural techniques. Nonetheless, there is a significant

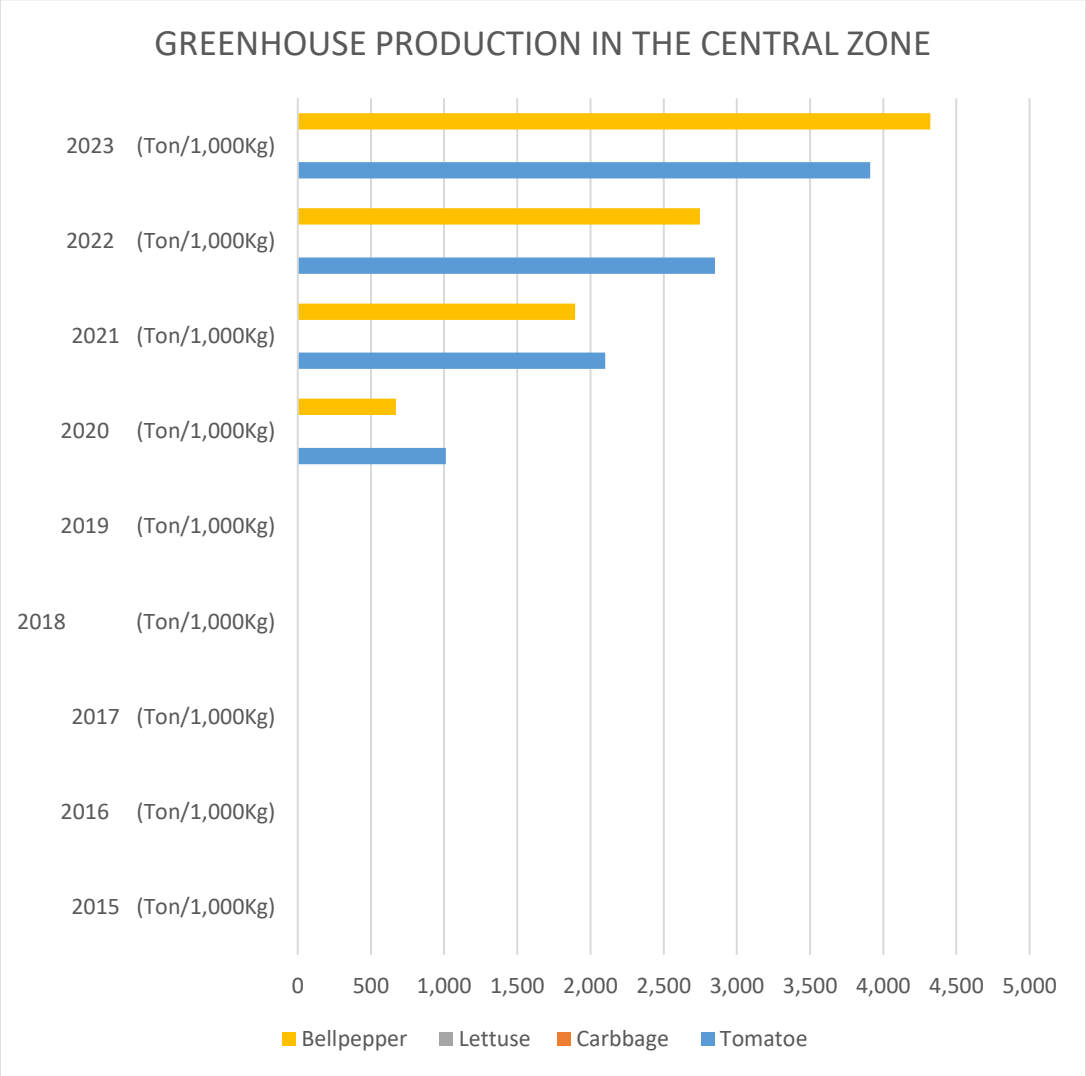
(and unfulfilled) need for food in many parts of Nigeria, especially in the vicinity of major centers. In local markets, the greatest demand is still for inexpensive food, but in urban areas, upscale specialty markets are expanding (KII/Male/59/Bokkos/September/2025).

Chart 1



Greenhouse production of some vegetables on the northern senatorial zone shows continues growth with tomatoes leading likely due to wide acceptability and consumption rate, market space and level of skills acquire over the years in terms of production. Even though storage facilities are rarely found in the state with huge post-harvest loses across the seasons. It is also discovered that most of the elites and middle class in the state are within the northern zone considered cosmopolitan with so many offices of governments, businesses and internation organizations. These factors and the quests for alternative source of improving livelihood in the midst of economic hardship pushes individuals to greenhouse agriculture. Though, government investment in terms of inputs, sensitization and awareness creation with increase in hospitality businesses like hotels within the zone spikes production.

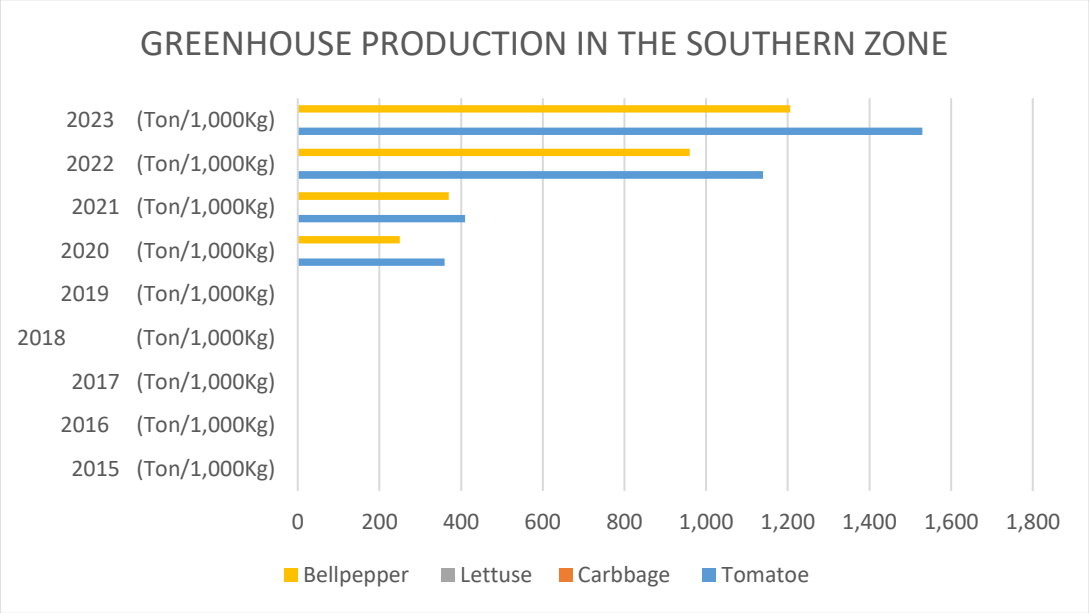
Chart 2



Source: Compiled from the field (September, 2025).

Unlike the northern zone of Plateau state, greenhouse production of vegetables is seldom practice with a reduced interest. This may be as a result of the uninformed population which is large in number, the economic dispositions of few interested farmers to access minimum greenhouse facilities may have been responsible. Similarly, distance from the zone where the farms are located to the end users (consumers) and the marketers' example, off takers/middle men does not provide economic benefits as such attention is more on the northern zone of the state. Instead, the zone maintains its traditional open irrigation as a major and acceptable means of accessing vegetables, nutritionally affordable foods. The post-harvest challenges are prevailing issues that remain unattended.

Chart 3



Source: Compiled from the field (September, 2025).

The southern zone of the state is greatly affected with unwillingness of farmers to embark on greenhouse farming. Reasons are not far from the fact that the location is far from the cosmopolitan northern zone with huge number of populations who are uninterested, nor aware of the exotic vegetables such as bell peppers and many others. They are instead, comfortable with their traditional mode of food production and their dietary intake. Market opportunities and storage facilities unavailable thereby discourage potential investors. The low-land zone is mostly humid promoting mangrove vegetations and root crops with little accommodation for shrubs flowering plants productions. Greenhouse would have been good except for the fact that distance and market space are considered huge setbacks.

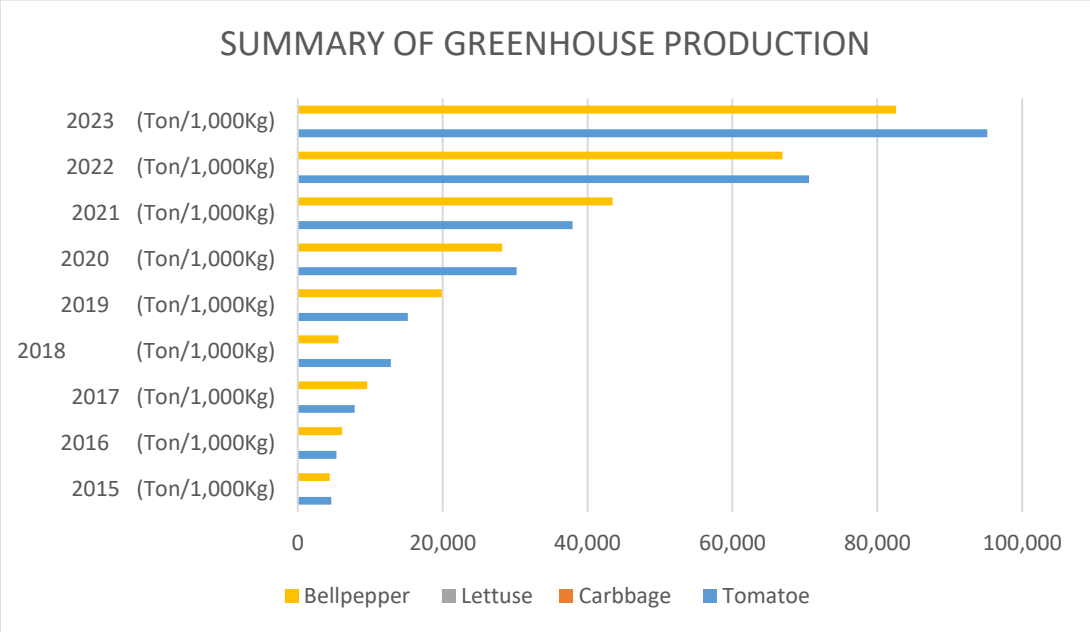
Table 6: Plateau State Summary of Green Housing Production

	2015 (Ton/1,000Kg)	2016 (Ton/1,000Kg)	2017 (Ton/1,000Kg)	2018 (Ton/1,000Kg)	2019 (Ton/1,000Kg)	2020 (Ton/1,000Kg)	2021 (Ton/1,000Kg)	2022 (Ton/1,000Kg)	2023 (Ton/1,000Kg)
Tomatoe	4,646	5,351	7,838	12,847	15,171	30,224	37,932	70,572	95,181
Cabbage	0	0	0	0	0	0	0	0	0
Lettuce	0	0	0	0	0	0	0	0	0

	2015 (Ton/1,000Kg)	2016 (Ton/1,000Kg)	2017 (Ton/1,000Kg)	2018 (Ton/1,000Kg)	2019 (Ton/1,000Kg)	2020 (Ton/1,000Kg)	2021 (Ton/1,000Kg)	2022 (Ton/1,000Kg)	2023 (Ton/1,000Kg)
Bell pepper	4,429	6,154	9,594	5,594	19,868	28,215	43,456	66,923	82,582

Field Work, September (2025).

Chart 4



Source: Compiled from the field (September, 2025).

Greenhouse food production in Plateau state has gain momentum over the years with an Israeli Company through direct foreign investment and partnership with the Plateau state government during Da Jonah Jang administration (2007-2015). Continuously, vegetables production in the state have seen exponential explosion greatly influence by greenhouse production. The economic returns, nutritional dietary gains and the leverage derived in food productions under a control system supported this growth within the agriculture subsector.

Challenges such as pests, technical awareness, lack of availability of technology, market space, climate issue, lack of access roads, insecurity and financial capacity are the major challenges faced by the greenhouse farmers. Off takers or middlemen within the value chain on the other hand deprive farmers of optimum value addition on their investment.

It is incontrovertible that environmental laws are imperative tool for the management of the environment which has direct impact on land ownership, usage and management. The

task of regulating and controlling drivers of greenhouse emissions lies on a strong legislation, or a policy backed by legal force. Unfortunately, these legal instruments are inadequately executed as a result of the laxity on the part of the agencies that are responsible for enforcing and implementing the legislation and policies. Thus, the major challenge to enforceability of climate change laws is the substandard implementation actions couple with overburdened traditional regulations across various ethnic groups.

Discussion of Findings

Based on the analysis, the following findings were observed:

The study reveals that Plateau Government does have policy on greenhouse initiative, though it has agencies facilitating climate smart farming such as greenhouse initiative in order to boost agricultural activities in the state. The State Government also established agriculture marketing board aimed at enhancing the marketing of farm produce and improving food security in the State. In addition, effective services of several federal government institutions in the state provides several agricultural support schemes such as Agricultural Credit Guarantee Scheme Fund (ACGSF), NIRSAL, seeding Programmes, Nigeria Agriculture Insurance Corporation and many others.

Additionally, according to Eme et al. (2024), many investments are not targeted at the agricultural sector and a lot of greenhouse farmers do not have access to credit facilities, in the face of high cost of installations materials at take-off. Interestingly, food produce in greenhouses' is of higher nutritional balance which not many people know of its impact on human health. These challenges make it difficult to address issues of food production locally and consequently impact the attainment of the set target of SDG 2. The relevance of the production theory to the study is that it provides explanation for the success and failure of a production firm in Plateau state. It emphasized that the level of technical efficiency of a particular firm is characterized by the relationship between observed production and some ideal or potential production.

Finding also reveals that Population increase, environmental issues and insecurity appear to be contributing to factors hindering greenhouse initiative and affecting the availability, accessibility, affordability and sustainability of food in Plateau State. Also, the large population continues to relocate to the urban areas in search of white-collar jobs which do not exist. This youth rural-urban drift makes it difficult for the country to be food secured. Flood, soil leaching, drought, desertification are environmental issues affecting availability of food in Nigeria. According to Flaherty & Abdullahi (2024), the greenhouse system has been starved of federal funding and insecurity of farmers and farms alike. A recent report of the escalation of the crisis on 26th January, 2024 indicates that 30 people were killed in renewed violence in Nigeria's central Plateau State where clashes between Fulanis herders and farmers occur. Another report suggests that in North- Central Nigeria,

Farmer-herder clashes in Benue and Plateau states have intensified, with the frequency and fatality of incidents higher in the second quarter of 2023 than in the same period in 2022 (Famine Early System Network, 2024). The production theory explains that the measurement of firm specific technical efficiency is based upon deviation of observed output from the best production or efficient production frontier. If a firm's actual production point lies on the frontier, then the firm is said to be perfectly efficient in the use of the production inputs.

Conclusion

It is observed that food security; using greenhouse initiative approach has the tendency to improve security of food and sustainable development if strategical efforts are made such as; policy development and domestic production of major greenhouse inputs across the value chain. Leakages from mismanagement of resources should be avoided. Expected results in the course of investments in agriculture were not realized given the unstable political environment created by the elites. The collapse of commitments by the bureaucrats in ensuring right policies are developed and implemented as designed may also have direct and indirect consequences on food security initiative in the country.

The findings of this study shows that factors such as cost of materials, climate change, conflicts, security and larger communities are uninformed about the nutritional impact of vegetables produce from greenhouse. Very critical is the role of cooperation amongst farmers to establish functional cooperative bodies to narrow gaps between the end users, farmers and the policy makers in order to maximize returns on their investment.

Recommendations

Having considered the findings from the study, the following measures are recommended:

i. Increase synergies and collaborations leveraging on new technology among greenhouse farmers, policy makers and research institutes and making appropriate policies and decisions at local, subnational and national levels about short and long-term strategies to improve greenhouse initiative and combat the impact of climate change on food security.
ii. There is the need for increase in funding and provision of security by both the Federal, State and Local Government leveraging on mechanized faming and provision of adequate farming inputs to drive increase agricultural productivity. This will help to address extent to which the factors hindering greenhouse initiative affect the availability, accessibility, affordability and sustainability of food in Plateau State.
iii. Need for awareness creation on the health impact of vegetables grown using greenhouse technology.

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