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The Impact of Climate Change on Nigerian Agricultural Enterprises: A Rural Community Farmer Stakeholders Perspective

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Abstract

The study examined the effects of climate change on Agricultural businesses in Nigeria, Anambra state (Nawfia community). Farmers who reside in the region are vulnerable to climate change, changes in climatic factors such as irregular rainfall and temperature poses a significant challenge to most rural farmers who reside in the region and heavily depends on crops and livestock farming to maximize profit. Extended changes in temperature and precipitation varies overtime and this affects agribusinesses. Crop production and livestock farming are major source of income for most farmers in Anambra state Nigeria, therefore we examined how climatic factors such as temperature, rainfall, humidity, and seasonal variations can affect each farmers' business in the region using qualitative research method through interview. To determine the impact of the change, we selected major crops and livestock common in the region, such as maize, cassava, yam, goat, chicken and pig for a case study. The result indicates that climate variability has significant impact in determining agricultural output and economic activities, these significant changes has led to food insecurity, low profit maximization, reduction in agricultural production and low food supply chain.

The paper argued that climate change affect farmers in the community in different ways, and they have different methods to tackle the problem when it arises. However, most farmers from this region have limited knowledge about climate information and how the knowledge can help them mitigate and adapt to the impact of climate change. Most of the farmers still rely on traditional agricultural practices to tackle climate related problems, because of their limited knowledge about climate smart agriculture (CSA), most agribusiness farmers find it difficult to engage in climate-resilient agriculture practices such as crop rotation, organic farming, cover cropping, crop and livestock diversification and precision livestock farming (PLF) for proper adaptation to weather changing conditions.

In addition, Government and other Agricultural institutions support is essential to assist farmers during climate change. From the study, the government is not doing enough to assist agribusiness farmers by organizing programs to provide basic climate knowledge, insurance against climate risk, grants and loans at the grassroots level to assist rural farmers in their businesses. Farmers

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lack the financial capability to purchase agricultural equipment's that will enable them adapt to the changing climate and make farming more efficient and profitable.

The paper therefore recommends that the government should take proactive measures to support, implement and encourage robust agricultural policies to address climate challenges faced by rural farmers in their respective businesses, in addition, it is essential for farmers to form cooperatives which will enable them to share knowledge, resources and access the market, this will help them adapt to uncertainties, increase food production, maximize profit and increase food supply chain without harming the environment.

Keywords: Climate, Agriculture, businesses, Crop, Livestock, Profit, Rural farmers, Temperature, Rainfall

Introduction

Background of the study

Climate change is seen as a major problem affecting food security, agricultural enterprises and the environment, world population keeps increasing without adequate food supply to meet the growing population (Alexander, 2016). Information shows that changes in climatic factors such as temperature, precipitation, sea level rise affects agricultural enterprises especially low-income countries where climate determines the level of production and distribution of agricultural commodities (Frankhauser & McDermott,2014). Countries such as Nigeria, Kenya, Ghana are vulnerable to climate change. Nigeria being susceptible to the effects of climate change experience high temperature, drought, erosion and heavy flooding due to weather changes. These changes in climate condition is mostly human induced and a major global concern leading to loss in biodiversity (Diaz et al,2019), and damage to the entire ecosystem, affecting the way communities interact, trade and function with each other within the environment.

Agriculture is a major contributor of food, income and employment opportunities in Nigeria, engaging in agricultural activities has helped the nation increase her GDP to 65% and provide job opportunities for 80% of the population (Federal Republic of Nigeria, 2000). However, climate variability has been a major concern in the country, its consequences have posed significant problems by increasing food insecurity, displacing livelihoods and affecting rural farmers who depend on agribusiness for profit maximization and survival.

Numerous scientists have studied the impact of climate change and how they then affect agriculture in general, while there are limited studies on how these changes can affect sustainability in agricultural businesses, profit maximization and food supply chain. The study addresses the deficit in knowledge on how the effects of climate change affect agribusiness which focus mainly on smallholder farmers who are the major food manufacturers in South Eastern part of Nigeria, how they can moderate and adapt to the impending changes in their environment (Williams et al,2015).

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The study will employ qualitative method of data collection to investigate how climate change affect farmer's business, this will be done through semi structured interview in order to understand how extreme weather conditions affect crop (Lesk et al,2016) and livestock production. Through this process, we identify experiences shared by farmers to determine how they are affected and the possible solutions to the menace. The study will further bring solutions to policy makers, agricultural and research institutes on how to improve their businesses, and adapt to climate change effects through resilience practices.

Statement of the Problem

The effects of climate change in Southeast Nigeria has led to increase in natural disaster such as flood, erosion and unfavourable weather conditions. It has contributed to 87.6%(Oyanrian,2020). significant decline in crop output (salary et al 2019). In addition, there have been uncontrollable pests and diseases as a result of the changes in the environment, disrupting planting season time which leads to loss in biodiversity and toxic environment. Due to the unpredictable weather conditions, agribusiness farmers find it difficult to manage their crops and livestock.

Anambra state Nigeria has experienced flood leading to damage of crops like maize, cassava and other staple food leading to food loss and waste (Anabaraonye et al 2022). Its implication has resulted to unfavourable conditions of farm animals, reducing their immune system and making them prone to diseases (Godde et al,2021). Incidence of flooding and other unfavourable weather conditions as a result of climate change has led to high operational cost, making supply of agricultural commodities difficult among farmers.

In conclusion climate change climate change effects on agricultural businesses have a wide-ranging impact on crops, environment and livestock, therefore it is essential for farmers and other agricultural organizations to improve adaptation and mitigation measures for effective sustainable agribusiness practices in Nigeria.

The research is significant because it helps farmers to deal with uncertainty that may arise from climate related risk, giving farmers adequate information to combat the hazard, better decisions can be made to promote climate smart agricultural practices (Ceglar & Toreti,2021). In addition, different agricultural policies have been made in Nigeria to promote agricultural sector but none emphasized the need to integrate policy to combat climate change. Therefore, this study will enable policy makers to integrate climate resilience practices when formulating policies to protect the ecosystem, promote international trade and enable smallholder farmers to profit from agricultural investment.

This paper will focus on the South Eastern part of Nigeria which is vulnerable to climate change and investigate how to reduce the impact of climate change affecting crops, environment and livestock production (Godee et al,2020), examining the economic implications of climate change on farmers' investments to determine how these changes affect farmers and proffer solutions that will contribute to farmers' skills and sustainable development. However, there are challenges due to limited frame required in collection and data analysis.

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The study region of Nawfia in Anambra state Nigeria is characterized by a tropical environment, with rainfall and humidity declining inland from the coast. The region is characterized by distribution of heavy rainfall and consistently high temperatures (Balogun et al, 2012). While the daily minimum temperature rarely drops below 18'C, its average daily maximum temperature is typically above 27'C throughout the year. Between the region's northern and southern borders, the region's total annual rainfall rises from 1500 mm to more than 2500 mm. The area is characterized by native vegetation which is affected by shrub burning for agriculture farming (Ibeanu & Umeji, 2003). Generally, the soils of the study area were derived from shale and sandstone parent materials which influence agricultural productivity.

Research Questions

To find effective solutions to mitigate climate change effects, the study revolves around answering the following research questions:
I. Will the impact of climate change affect overall productivity and profitability of agricultural enterprises in Southeast Nigeria? (Mawejje, 2024)
II. Which ways does climate change affect food supply chain from production to consumption? (Oriekhoe et al,2024)
III. What are the mitigation and adaptation measures to climate change and how can we integrate the knowledge with innovations to achieve sustainable agricultural practices? (Lawler et al, 2013).

To facilitate understanding, this paper is divided into many major sections. Section 2 examines the literature on theoretical review, climate change and critical discussions on Agriculture in Nigeria, particularly the south. Section 3 discusses the study's research strategy and methods. Section 4 provides and examines the findings, and Section 5 summarises the key discoveries and their implications for future study. This organisation strives to give a thorough knowledge of the study setting, methodologies, findings, and conclusions.

Review of Related Literature

Theoretical literature Review

Throughout this paper, climate change and agricultural industry are connected in a mutually supportive process. Agribusiness farmers must be aware of the patterns of climate change.

Conceptual issues

The objective of the FAO is to ensure that people get sufficient food to keep healthy and avoid malnutrition, in order to ensure effective food production, creating awareness about climate change and how it influences production is sustainable for agricultural production.

Agriculture is a system of producing crops and livestock to serve the population, it involves plants, animal, and forestry production which ensures economic development through creation of

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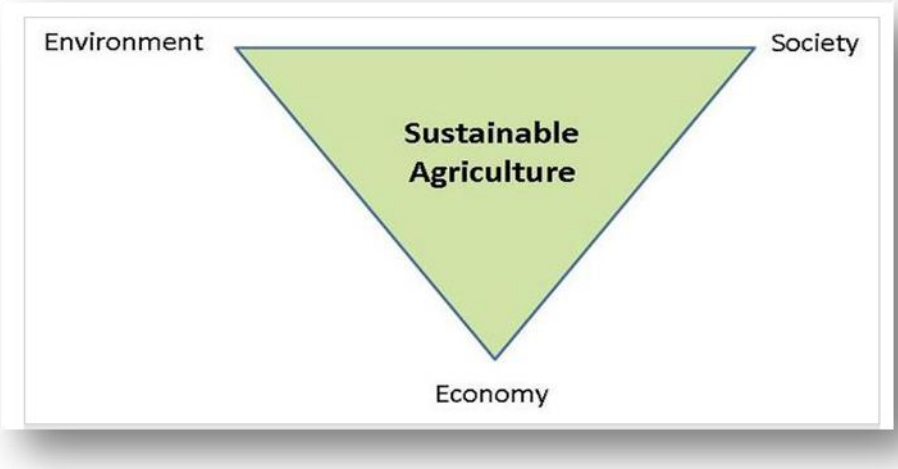
job opportunities, and rural infrastructure development. (Diaz et al,2021) described it as cultivation of soil and rearing of animals for food and industrial production in a sustainable way.



Source: (Sonaj et al,2011)

The above figure showed how Sustainable Agriculture integrates the environment, society and economy for effective food production

The above illustrates how sustainable agriculture integrates with the environment, the economy and the society. This means that Agriculture plays a vital role to determine how the economy works to meet daily needs of future generations.

Concept of Agriculture and Agribusiness in context

In Nigeria, subsistence farming is predominant in rural areas, through this system of farming farmers generate food and revenue for themselves. Studies shows these farmers produce 90-95% of the total food production,90% of its export and 80% of its labour, farming operations is characterized by the use of different farm equipments. (Nwogwugwu et al, 2023).

Agribusiness on the other hand involves commercial activities that deals with production, delivery, processing, marketing and consumption of agricultural products**.** A key factor in determining sustainability and economic viability in the agriculture sector is the expansion of commercial activity. Due to its major effect on global food security, food supply chain management, and economic and environmental development, it is a crucial sector of the Nigerian economy (Zylbersztajn, 2016).

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The concept of climate change

Climate change, according to the IPCC (2014), is a long-term alteration in a region's weather patterns. Over the past few decades, human and industrial activity has affected the world, changing ecosystems and resulting in flooding, droughts, and sea level rise. World Meteorological Organization (WMO) has finally defined climate change as any type of adjustment to the mean value of meteorological components such as temperature or rainfall that occurs over a period of ten years or more. This includes changes to economic, social, and environmental aspects of life (WMO, 2007).

The magnitude of the effects of the changes in the environment due to climate change affects the food production system by 15% globally and 19.7% in developing countries. This however affects farmers profit maximization.

Basic Theories

To increase farmers' production and profit margin basic theories highlights the necessity of enhancing the communities' resilience to climate change.

Resilience theory is a measure of a system persistence and capacity to adapt to climate changes, communities that are vulnerable to climate risk should modify their farming methods to adapt. Adaptive theory was proposed by (Walter,1997) as a situation that allows individuals and community to learn and manage ecological systems through a structured process, and their ability to adjust to climatic condition. Finally, risk management system of insurance protects agribusiness farmers against future loss, these loses can be agricultural products, land and farmers health. The nature of the insurance depends on different nations, and the nature of problem which may occur from the agricultural sector. (Lin et al,2023).

R. Edward Freeman (1984) developed the stakeholder thesis, which held that companies should take into account the interests of all parties involved, not just shareholders. It highlights how companies are linked to a number of groups, including workers, clients, suppliers, communities, and the government, all of whom can have an impact on or be impacted by them. Stakeholder theory promotes a more comprehensive approach to business, acknowledging that a company's success depends on the happiness and well-being of all stakeholders, rather than just shareholder wealth. According to Owoeye (2023), there are essential components of the stakeholder theory. First, the wider breadth is emphasised by the stakeholder theory. The conventional focus of corporate management is expanded by stakeholder theory to encompass all stakeholders with a vested interest in the company, not only shareholders. Secondly, it extends the concept of interconnection. Owoeye (2023) concurred that the stakeholders had to exhibit their effective interdependence and reciprocal impact on the success of the organisation.

Thirdly, stakeholder theory depends on value generation. Creating value for all stakeholders should be the company's main priority. Moreover, ethical issues are just as significant. This highlights important moral considerations on how companies need to handle their interactions

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with different stakeholders and possible conflicts of interest. Finally, sustainability needs to be emphasised. Businesses are encouraged by stakeholder theory to think about the long-term viability of their operations and the long-term welfare of their stakeholders.

Agriculture in Nigeria

The agricultural industry in Nigeria contributes significantly to the GDP of the nation, usually between 22 and 25 percent. Although Nigeria's economy has historically been mostly driven by the oil industry, agriculture continues to be an essential sector that employs a sizable section of the people and makes a significant contribution to the country's economic output. According to Statista Data, Agriculture sector in 2023 contributed 23% to the Nigeria's GDP compared to the Industrial and services sectors with 33% and 43% contribution to the GDP. The agricultural industry includes forestry, fisheries, cattle, and crop production. One of the sector's main contributors is frequently cited as crop production. A significant portion of the population depends on agriculture for livelihoods and food security. Notwithstanding its significance, the industry confronts difficulties such as high input prices, instability, and restricted access to financing (Owoeye 2023). Nigeria has a sizable market and a lot of agricultural area, which presents chances for expansion and a higher GDP contribution, particularly with programs like the African Continental Free Trade Agreement (AfCFTA). Farming produces food such as maize, cassava, palm oil which helps to curb food insecurity, its performance has contributed to the growth of the country's GDP. Crop production accounts for 87% of total agricultural output, while livestock, fishery and forestry contribute to 8.1%, 3.2%, and 1.1% respectively.

Policies and programmes aimed at enhancing agricultural businesses in Nigeria

The NSPFS program was initiated to provide credit facilities to both old and young farmers and to give them access to credit facilities, to help increase their production and maximize their profit, the program concentrated majorly on smallholder farmers in the rural areas to promote sustainable farming practices and reduce poverty in those area. This current policy increased farmer's production and profit making in agribusiness. In addition, it had a positive impact increasing the GDP by an average of 29.76% creating the most effective economic impact by focusing in food production through optimal land use and effective irrigation system. Throughout this period, agriculture contributed to 25.15% of the average GDP (Nwankwo et al, 2024). Although the policy had impacted the economy, the African Development Fund in 2006, noted that the absence of business structures reduced the policy's ability to further develop the nation.

In contrast to the NSPFS policy, the ATA policy took a different dimension by treating farming as a business and providing capital to boost farm productivity. In addition, the policy involved the private sector in processing of primary products into secondary products and distribution of these farm products. Because it handled agricultural problems from a new dimension that was not familiar to both farers and the corporate sector, the policy did not succeed. Its contribution to GDP growth was 20.9% which was seen as the lowest. To achieve policy goals towards

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developing and developed nations (Nwankwo et al, 2024), Cena opposed the continuance of this policy by the next administration as an obstacle to achieving effective policy goals.

Climate trend in Nigeria

Temperature and rainfall are two significant climatic factors, because of their potential effects on crops and livestock, it's important to analyse climate historical data to analyse the future and improve mitigation and adaptation plans (Abbass et al. 2022)

According to Ogunrinde et al (2019), rainfall pattern was examined in the past few decades, the observation shows that 90% of the country had a decline in rainfall trends which has significant shift in agro-ecological zones. Rainfall occurrence between 1969 and 1971 differed from the pattern in1931 to 1960 and 1961 to 1970 respectively with 7% annual decline. Subsequently, Ogungbenro & Morakinyo, (2014) used change point analysis to determine rainfall pattern in several climatic zones in Nigeria, it was discovered that there was a common change point in dry to wet seasons in all zones between 1969 and 1972.

Nigeria Meteorological Agency (NIMET) demonstrated remarkable surge in both maximum and minimum temperatures by 2.47% and 1.37%, respectively. The temperature rise aligned with significant decrease in rainfall pattern, which has dropped by 19.58%. In Addition, between 2000 and 2009, temperatures continued to rise, particularly during the time period of April, July, August, October, and November.

Climate change in Anambra State and its causes

Climatic changes in Southeast Nigeria alters the environment, the changes in environment occur when there is irregular rainfall, increase in temperature, erosion and flooding. These changes affect agricultural farmlands which result in poor production, high mortality of livestock and reduction in profit maximization (Ogbuchi,2020).

In addition, food supply chain process which includes manufacturing, processing and consumption are affected. Anambra state Nigeria experienced heavy flooding which displaced 2.3 million indigenes, during this period smallholder farmer experienced low yield (Nduba et al, 2024). and harvest, this resulted in low supply of agricultural produce.

Global warming is as a result of human activity on the planet, changes in climate are caused by expansion in agricultural production which results in the release of emissions, combustion of fossil fuels like coal, oil and natural gas, sea level rise which can lead to flooding, deforestation and sun intensity.

Empirical Literature

Kabubo-Maria & Karanja (2006) paper analysed the impact of climate variability on agriculture. The paper focussed on the Ricardian analysis of 200 farms where the effect of climate variability on net revenue were explored. The paper found out that climate change affects agricultural

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production and output, in their studies, they noticed that when winter temperature is warm it tends to increase crop revenue while hot temperatures reduce the revenue made from crops. Furthermore, the paper found out that each farmer that engaged and practiced adaption are able to cover potential losses from climate variability. The paper recommended that regions should put in place plans and measures for unexpected event of climate conditions.

Kurukulasuriya and Ajwad (2010) paper furthermore investigated the impact of climate change on agriculture. In their findings showed observed that climate change affect agribusinesses and smallholders' profitability.

Kandulu et al (2012) paper investigated the mitigating economic risk from climate variability in rain-fed agriculture through enterprise mix diversification. According to the research, there aren't many evaluations of enterprise mix diversification as a tactic for reducing climate risks and ensuring the long-term sustainability of agricultural businesses. To determine how much enterprise mix diversification can reduce climate-induced variability in long-term net returns from rain-fed agriculture, we used APSIM modelling in conjunction with Monte Carlo simulation, probability theory, and finance techniques, using the Lower Murray region in southern Australia as a case study. According to the study, diversification can raise the mean of 10% of the worst potential annual net returns (Conditional Value at Risk) by up to A$100 ha1, decrease the standard deviation by up to A$200 ha1, or 52% of mean net returns, and enhance the likelihood of breaking even by up to 20%. The paper concluded that, for farmers in marginal locations, enterprise mix diversification can also be a useful tactic for protecting against economic risk brought on by climate change.

Toong Hai Sam et al (2021) observed that it is imperative for stakeholders to adopt climate smart technology to improve agribusiness during climate change. Furthermore, Odejimi & Ozor (2016) examined if climate affect agricultural output, in their findings, government should spend more on agriculture to increase productivity. Grigorieva et al (2023) in their study on the adaptation of agriculture to climate change, climatic factors result in decreased yield potential, proper farming strategy should be encouraged. Lesk et al,(2016), Nwankwo et al (2024), Ulibari et al (2021) & Williams et al (2015) examined how changes in climate affect agriculture production and how farmers can adapt to these challenges.

Research Gap

The study of climate change is not new; however, from the review literature it shows that gaps are still left to be filled. Different studies examine how climate change affects crops and livestock but fails to examine its impacts on farmer's income. Many smallholder farmers in Nigeria generate their income through agribusiness therefore it is important to study how changes in climate patterns can affect their businesses. In rural areas, climate change and knowledge are perceived as ineffective, and progress toward adjustment and the implementation of climate change policies is disguised in culture. Furthermore, there's a chance that livestock and crops will respond differently to climate change; although some crops may require sufficient

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rainfall to survive, others may not fare as well. Thus, the study looks at how crop and livestock output would be affected by climate change

Research Methodology

Introduction

In order to investigate how climate change affect agribusiness, five different villages were selected studies, Umuriamu, Umukwa, Ifite, Mmimi and Eziakpaka, three farmers were selected across each village. Qualitative method of data collection was used through semi structured interview to gather in-depth information and identify experience of each farmer. The study utilized qualitative inductive reflexive thematic analysis approach using Nvivo software for statistical analysis.

Research design

The research will adopt the qualitative method research design to examine the effects of climate change on Agricultural businesses in Nawfia Community. Using thematic analysis to identify themes by studying transcribed data.

Research Methods

Research participants were selected through random sampling to minimize bias this was done by selecting farmers who have over ten years of farming experience and reside in the region used for study (Sharma, 2017). Data was collected through phone interview, which gives room for participants to opt out if they are not comfortable.

Inductive Reflexive Thematic Analysis

Inductive reflexive thematic analysis is a qualitative research method that involves identifying, analysing, and reporting patterns themes within data (Braun & Clarke, 2006). The procedures involve: getting acquainted with the data, generating initial codes, searching for themes, reviewing themes, defining themes and producing report.

Ethical Considerations

To ensure proper ethical behaviour, the researcher adhered to specific guidelines which includes; respect to all research participants, respect for integrity of knowledge, respect for livestock and the environment and making sure the health, safety and data of research participants are all protected during the course of the study (BBSRC, 2006 & Council for science and technology, 2005). This ensures that the research is reliable and credible.

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Presentation of Results and Discussions

Introduction

This section highlights the responses received from the 15 farmers that were interviewed from Anambra state Nigeria to share their experience on how climate change has affected their various businesses and to determine whether there are measures put in place to curb these challenges. The Nvivo software was used to analyse the interview conducted, thirteen themes were generated which includes: adaptation strategy, adverse economic effects, change in environment, beneficial effect, consumer preference, government support, proper planting time, reduced product quality and slow down supply chain. Most occurrence words mentioned by the farmers is shown in the figure below.

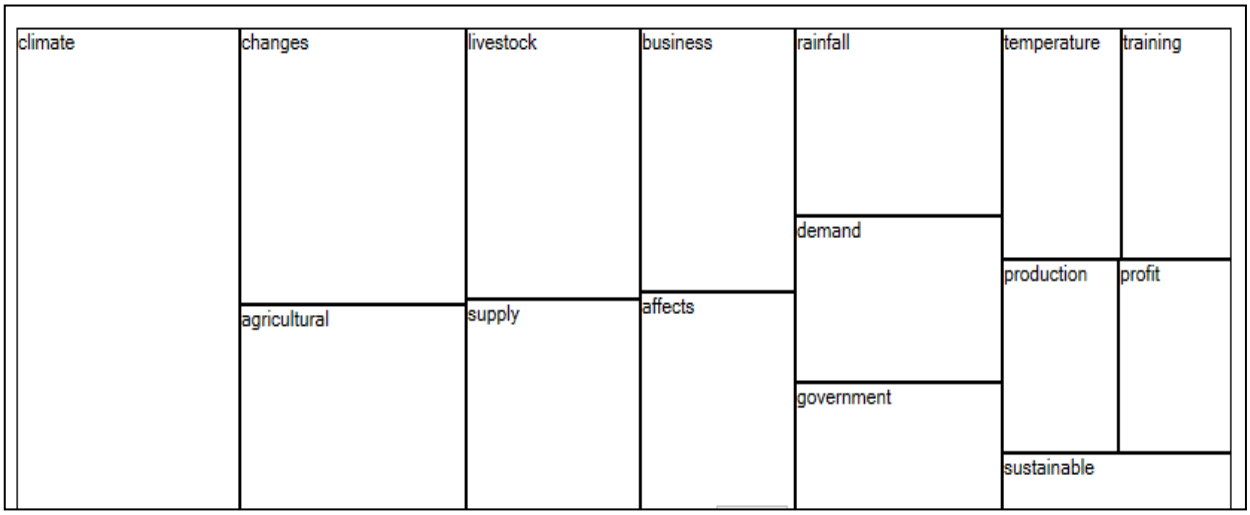

Figure 1 - Word tree map

The above figure highlights essential words used by the farmers such as: supply, government, etc. These words are important to the study concept in the course of the interview.

Demographics

15 farmers were selected across five different villages who have over 10 years in livestock and crop production, they are involved in different Agrobusinesses which includes cassava, maize, vegetables, poultry farm, pig, goat and catfish farming. These farmers were interviewed and data collected and transcribed, this can be seen in appendix A.

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Generation of themes

Table – 1 Themes, files and references

Name	Files	References	Created By
Adaptation Strategy	13	27	A
Adverse Economic Effect	13	14	A
Changes in Environment	10	12	A
Consumer Preference Effect	2	2	A
Governmental Support	7	8	A
Increased Pest and Disease	4	5	A
Poor Governmental support	8	14	A
Proper Planting Timing	4	4	A
Reduced Product Quality	8	9	A
Reduced Product Quantity	7	8	A
Self-Development	6	7	A
Slowed down supply chain	10	12	A

Fifteen responses to the interview questions

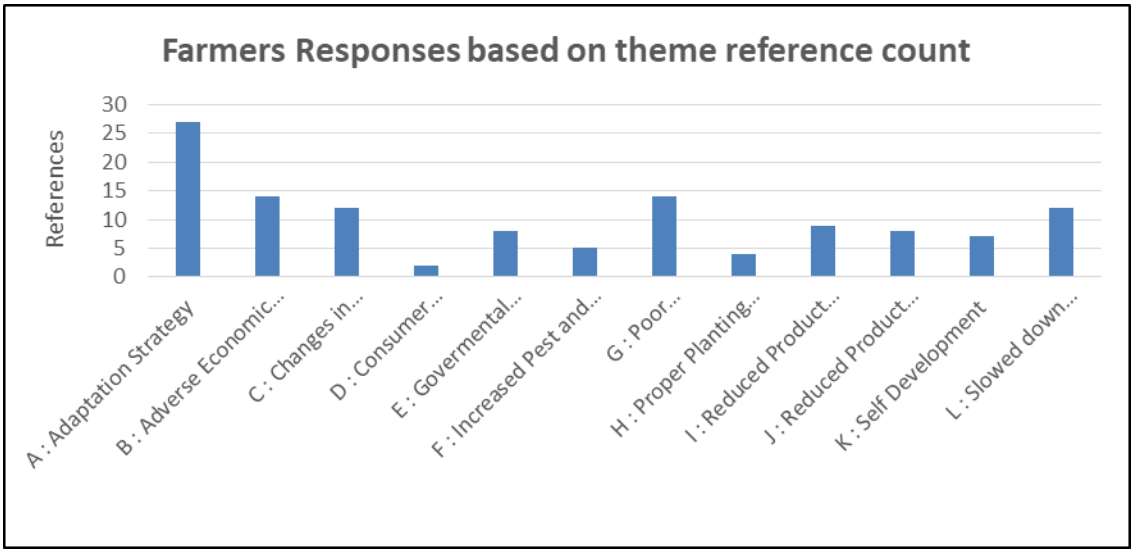

Figure 2 Farmers responses based on theme count

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Figure 2 above summarizes the response from 15 farmers across five villages, highlighting major problems that hinders their business operations. Adaptation strategy is seen with the highest reference, depicting farmers concern on adjusting to the changing climate conditions. Economic challenges are also prominent showing financial challenges and low profit maximization is a major problem among farmers.

Supply chain disruptions and environmental changes are also significant concerns for farmers, noting that these areas are affected as a result of shift in climate pattern. Opinion of farmers on Governmental support are mixed, with some farmers finding it helpful while others feels government is not doing enough. However, proper planting time, reduced product quality and quantity and farmers' self-development are essential but not a major top concern. In conclusion, the responses from the chart lays emphasis on proper adaptation, managing economic impact and dealing with environmental and supply challenges which usually occur as a result of climate change.

The responses are viewed in two general groups

i. Response related to negative or adverse effect of climate change on Agrobusinesses
ii. Response related to Adaptive methods developed by farmers over the years.

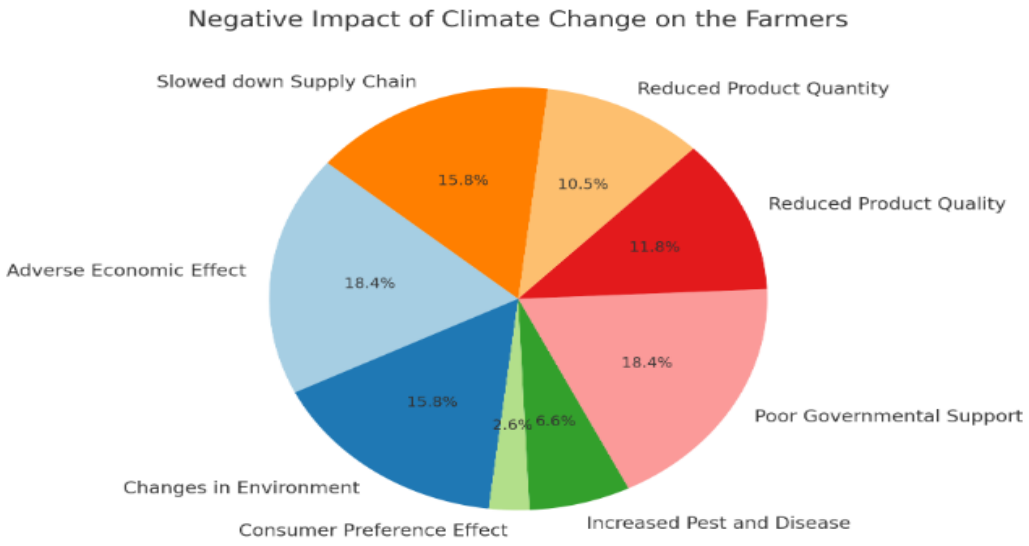

Figure 3 Negative impact of climate change

Response from the farmers shows that climate change has 18.4% adverse effect, this economic effect has significant implications on the agricultural product quality and quantity respectively which has led to 15.8% slowdown of food supply. In addition, changes in environment which occur as a result of global warming has led to increase in pest and diseases affecting farmers' crops and livestock. Finally, the government is not doing enough to provide knowledge about

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climate, providing grants and assisting farmers with agricultural innovative tools that will help them to tackle climate challenges

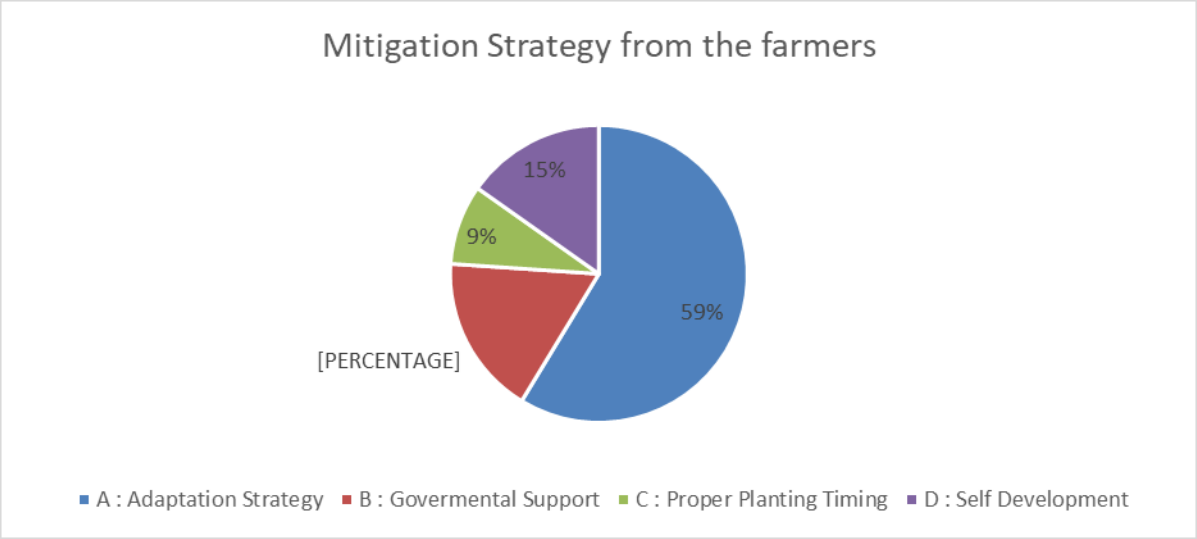

Fig. 4 Mitigation strategy adopted by the farmers.

The pie chart shows the mitigation strategy adopted on farming activities as reported by 15 farmers, with references distributed across several key themes.

Recommendations and Conclusions

Critical Findings

From the study, it indicated that changes in climate affect agricultural businesses in Southeast Nigeria (Kabubo-Maria & Karanja, 2006), due to these challenges farmers adopt different methods to minimize the effects of these risks, most farmers practice artificial irrigation during drought. However, they lack proper skills and technology (Toong Hai Sam et al 2021) to improve resilience to climate change. It is therefore essential to empower agribusiness farmers and their communities during climate change. Evidence from the research shows that the effort of the government towards mitigating the effects of climate change is minimal.

In addition, findings show a relationship that exist between climate change, low productivity and low profit maximization (Kurukulasuriya and Ajwad,2010). Agribusiness farmers in the community conform to this having experienced low agricultural output and profit making as a result of climate challenge. Variations in temperature and rainfall has increased livestock mortality and pest attack, therefore integrated pest management and precision livestock farming is encouraged to enable them manage their livestock against farm diseases.

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Response from the interviewees also acknowledges the need for more government support in Agriculture during climate change to help smallholder farmers curb climate crises which affect their business, this corroborate with (Obioha,2009) findings.

Recommendations

Recommendations based on the research findings.

i Climate change has been identified as a significant factor contributing to increased pest and disease prevalence, posing significant threat to global food security (Marmai et al,2022). The changing climate patterns, primarily warmer temperatures, create unfavourable conditions for the spread of pests and diseases that can have devastating impacts on crops and livestock. These changes leads to food insecurity. In addition, increase in temperature causes drought and hot temperature in the environment making it possible for pests and other diseases to attack farmers' crops and livestock. However, agribusiness farmers are advised to reduce carbon emission from their farms and renew energy in order to reduce the effect of pest and diseases caused by climate change (IPCC, 2018 & Zarkovic et al, 2022)

ii To improve resilience in agribusiness during climate changes, farmers need to be equipped with necessary knowledge and farming skills (Climate smart farming) to combat the challenges they encounter during climate shift. Government and other private organizations are advised to provide effective training on sustainable agricultural practices and climate smart agriculture (FAO,2014) such as improving farming technology, crop rotation, and precision agriculture, which will enable farmers acquire climate skills to tackle climate risks in order to improve production in their business.

iii To ensure sufficient income and profit maximization among agribusiness farmers, the state and local government agencies with other agricultural institutions should make favourable policies and provide grants and loans to agribusiness farmers as supported by (Nwankwo et al, 2024). This will enable them to increase production and expand their farm business across borders. This support will help to reduce the challenges faced during climate change. In addition, it will help to acquire farm machineries that will help to monitor the weather and livestock against climate related problems.

iv In order to reduce the challenges faced by the community and farmers, it is essential to encourage crop and livestock diversification, as seen by (FAO,2014). Some crops and livestock are more resilient to climate changes; this means they can thrive during this climate disaster. Therefore, it is recommended that farmers grow these crops and livestock because of their resistant to the changes in weather conditions. Through this system of farming, it allows agribusiness farmers to reduce risk and improve farming efficiency in order to mitigate during changes in climatic conditions. (Surminski, 2020)

v Forming cooperatives among farmers is encouraged (Manjula,2020), this will enable them to pool resources together and penetrate the market, increasing supply chain of agricultural products. Knowledge and skills acquired can be shared among farmers through this. In addition, it will be easy for them to obtain loan and grants from the government as cooperatives which will help them to thrive during changes in climate pattern

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5.3 Conclusion

The study shows that alterations in weather pattern affect agribusiness, however, farmers can adopt different agricultural practices to mitigate and adapt to climate risk. This study fills the gap in knowledge to determine how climate change can influence agribusinesses and strategies to take to maximize profit and improve food supply.

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