EFFECT OF FARMER-HERDER CONFLICTS ON FOOD SECURITY OF CASSAVA FARMERS IN IMO STATE, NIGERIA

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CERTIFICATION

This is to certify that this work, **"Effect of Farmer-Herder Conflicts on Food Security of Cassava Farmers in Imo State, Nigeria"**, was carried out by **Obasi, Akanele Chori (Reg No. 20194198278)** in partial fulfilment for the award of Master of Science (M.Sc.) Degree in Agricultural Economics in the Department of Agricultural Economics, Federal University of Technology Owerri.

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DEDICATION

This work is dedicated to God Almighty for His tender mercies and love. Also, for finding me worthy and granting me the grace to accomplish this work.

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ABSTRACT

This study examined the effect of farmer–herder conflicts on the food security of cassava farmers in Imo State, Nigeria, with the aim of understanding how conflicts influence cassava production, farmers' net income, and their food and nutritional well-being. The study was necessitated by the growing tension between crop farmers and pastoralists, which has become a major threat to agricultural productivity and food availability in southeastern Nigeria. A multistage sampling technique was used to select 90 cassava farmers from the two agricultural zones of Imo State. Primary data were collected using a well-structured questionnaire and analyzed using descriptive statistics, Ordinary Least Squares (OLS) regression for net income analysis, and multinomial logistic regression for the determinants of coping strategies, while body mass index and individual dietary diversity score were used to analyze the food security status, the drivers of the status was determined using ordered probit model. The average net farm income (NFI) per harvest was ₦117,117.78, while the return on investment (ROI) stood at 75.86%, indicating that cassava farming remained profitable despite recurrent conflicts. Results on the causes of conflict identified both remote causes—such as population pressure, land tenure insecurity, and competition over natural resources—and immediate causes, including sexual harassment of female farmers (mean = 2.54), indiscriminate bush burning (mean = 2.48), and crop destruction by cattle (mean = 2.39). The conflicts led to displacement of households, loss of farm assets, and abandonment of farmland. The Multinomial Logistic Regression revealed that access to credit ($p<0.01$) and farming experience ($p<0.05$) significantly determined the choice of coping strategies. Crop diversification (mean = 2.63) and fencing (mean = 2.36) emerged as the most effective coping strategies, while reliance on prayer or assistance from local leaders ranked least effective. The body mass index and individual dietary diversity have a mean value of 13.9 (SD = 1.97) with the respondents being moderately food insecure. Furthermore, results from the Ordered Probit Regression showed that access to credit (coef = 1.714, p=0.016) had a positive and significant influence on food security, while farmers' income (coef = -4.26e-06, p=0.052) had an unexpected negative effect, implying that income did not automatically translate into food security due to conflict-related losses and livelihood instability. Variables such as education, farm size, and land ownership had positive but statistically insignificant effects, while sex, age, and conflict frequency negatively affected food security. The study concludes that farmer–herder conflict substantially undermines cassava productivity, net income, and food security in Imo State. It recommends the establishment of community-based conflict management systems, improved credit access, farmer education on adaptive strategies, and enforcement of land-use policies to promote peaceful coexistence. The research contributes to knowledge by providing an integrated socioeconomic and econometric assessment of how conflict shapes the resilience and food security dynamics of cassava-based farming households in southeastern Nigeria.

Keywords: Causes, farmer-herder conflicts, food security, displacement, livelihood.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Agricultural production is an important source of livelihood and economic sustenance for the Nigerian population, as highlighted by studies of Sertoğlu, Ugural and Bekun (2017). Agriculture is a crucial element for economic growth, development, and poverty eradication in developing countries, serving as a vital engine and panacea for economic prosperity (Sertoğlu et al., 2017). Agricultural production involves the cultivation of crops and livestock for food, fiber, and other products. As earlier stated, agricultural production in Nigeria provides livelihood for majority of the population and is crucial for reducing hunger in Africa and Asia (Hood et al., 2023).

Cassava (Manihot esculenta crantz) is a perennial and drought resistant food crop. Its production is a veritable sustenance source for the majority of Nigerians, contributing significantly to farmers' household and national food security (Omoregbe, Awhareno, & Ekpebu, 2018). As a staple food crop extensively grown in Nigeria, Cassava supplies about 70% of the daily calories of over 50 million people in the country, it has also been estimated that the crop provides food for over 500 million people worldwide (Agu, et al., 2016). In 2004, Nigeria produced 38,179,000 metric tonnes of cassava (Etuk, Ifeanyi-Obi, & Ajanwa, 2013) and in 2018 its production topped to about 60 million tonnes (Ikuemonisan, Mafimisebi, Ajibefun & Adenegan, 2020) making the country the highest producer of cassava in the world. Forecasts indicated a steady increase in cassava production per hectare from 2024 to 2033, with projected yields rising from 17.33 tons per hectare in 2024 to 18.54 tons per hectare by 2033 (Edibo, Marcus, & Ogah, 2024). Despite topping the list of cassava producers globally in the past decade, cassava production has shown a drastic reduction to the ton of 45 million tonnes

of cassava produced annually (Okonkwo, Amaefula & Igwe, 2023). The deficit in cassava production is attributed to poor crop management, land tenure system, pest and disease infestation and farmer-herder conflict among others.

Conflict poses a significant threat to world peace and food security, as it involves disagreements and conflicts between people with opposing needs, ideas, values, and goals (Sani et al., 2021). Adzenga et al. (2019) in their research noted that food crisis in Nigeria is mainly due to land disputes and farmer-herder conflicts, hindering agricultural development, food availability, and economic enhancement. This issue underscores the need for stability, equality, and peace for socioeconomic goals to be achieved. In related studies by Gbatse et al., (2022) and Ajaero et al., (2021) it was noted that crisis, significantly affects the economic, political, and social operations of a community and its surroundings, causing substantial and detrimental effects on food security.

Furthermore, Solomon, (2021) is of the view that conflicts like the farmer-herder conflicts negatively affect farming communities and pastoralists, leading to significant financial consequences for all involved. Conflict between farmers and herders significantly reduces food production because of insecurity and difficulty in accessing farmland which makes it unsafe for cultivation and consequent destruction of planted crops by cattle during their grazing (Nnaji et al., 2022). Report by Kwaghtser (2019) indicated an approximately 56% decrease in food output due to these clashes, which disrupt agricultural activities and displace farmers. Reduced food production minimizes the coping capacity of those depending on agricultural resources as the only means of livelihood, makes them food insecure and consequently lowers their income (Nnaji et al., 2022). Food insecurity is a condition where individuals lack sufficient access to food, both physically and economically (FAO, 2022).

Contrarily, food security ensures all individuals have access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life (Utasi et al.,

2021). Food security is crucial for human sustainability and national security. It ensures adequate food for social and environmental well-being and maintains a robust economy. The goal is to meet the body's needs with adequate food availability (Fanzo 2019; Pérez-Escamilla 2017). The FAO has identified four key pillars that underpin food security: food availability, accessibility, utilization, and stability (FAO, 2022). According to Etuk et al., (2013), in a study conducted in Kwara State, it was cited that over 90% of interviewed farmers indicated that their greatest problem in cassava production is cattle herders' encroachment on their farms, which often led to conflict between the farmers and cattle herders.

Bello & Abdullahi (2021) in their study noted that the farmers-herders conflict in Nigeria revolves around the dispute between Fulani herders and predominantly Nigerian farmers, primarily based on the availability of arable land. It is exacerbated by population growth, straining natural resources and intensifying competition for livelihoods (Modupe et al., 2023). This issue, particularly in the Middle Belt and Southern Nigeria, has led to economic, political, and environmental tensions, posing a significant threat to Nigeria's food security and cassava agriculture (Udosen, 2021). Farmer-herder conflicts have a significant effect on food security in Nigeria, pointing to the need for conflict resolution strategies to safeguard agricultural activities and ensure food sustainability (Hyginus, 2022). This current study throws more light of the menace of conflicts in Nigeria, examines the effect of farmer-herder conflicts on the food security of cassava farmers in Imo State, Nigeria, and highlights the significant economic effect on cassava farming communities and the potential negative effects on cassava production.

1.2. Statement of Problem

There is an expected rise in global food demand by more than 50% by 2050, because of the effects of conflicts such as farmer-herders conflicts, climate change and other agrofactors like soil degradation which are expected to reduce crop productivity (Stewart et al. 2020). The persistent conflict between farmers and herders in Nigeria has become a significant threat to agricultural productivity and food security, particularly among cassava farmers in Imo State.

Conflicts between farmers and herders have led to disruption of agricultural activities and frequent confrontations and violent clashes between herdsmen and cassava farmers disrupt routine farming operations. These disturbances create an atmosphere of fear and anxiety, reducing farmers' productivity and willingness to invest in their fields. The resultant interruptions in planting, weeding, and harvesting cycles directly undermine cassava output and food availability (Eze and Okafor, 2024). This disruption undermines farmers' ability to maintain consistent crop production.

The conflict has resulted in the destruction of crops, property, and infrastructure, as well as the displacement of farming households. This loss of assets and livelihoods forces many cassava farmers into poverty and food insecurity, as they are unable to resume agricultural activities or access alternative sources of income (Adeyemo et al., 2024). It was stated that 30 million people in more than 60 countries were displaced or had their livelihoods destroyed by conflict every year in the 1990s (Chikaire et al., 2016).

Encroachment by herders and their cattle onto cassava farmlands has led to widespread abandonment of arable land. Fear of attacks and destruction of crops compelled farmers to desert their farms, further reducing the area under cultivation and exacerbating food insecurity (Adeyemo et al., 2024). The resulting land insecurity discourages investment in agricultural inputs and long-term land improvement. The encroachment of herders on farmland creates land

insecurity, forcing many cassava farmers to abandon their fields to avoid crop destruction and personal harm (Adisa, 2019). This abandonment reduces the total cultivated area and diminishes cassava output, further threatening food availability.

Cattle grazing on cassava fields often destroys both stems and tubers, leading to significantly reduced yields. This direct loss of produce diminishes the overall food supply and threatens the food security of individual farmers and the broader community (Eze and Okafor, 2024). This destruction lowers the food supply from cassava farms, a staple food source in the region.

The combined effects of disrupted activities, abandoned farmland, and crop destruction lead to decreased access to cassava for both consumption and sale. This scarcity limits the availability of cassava in local markets, undermining the food security of farmers and the wider population (Eze and Okafor, 2024). According to Echetama & Ohajianya (2021), the reduced access to cassava from farms caused by crop destruction and farmland abandonment negatively affects farmers' food security, limiting both consumption and market supply.

According to Adeyemo et al., (2024) the conflict imposes additional economic burdens on cassava farmers, including the costs of replanting destroyed crops, securing farmland, and coping with displacement. The conflict escalates production costs as farmers must invest more in protecting crops, replanting damaged cassava, and coping with insecurity. These increased expenses, coupled with lower yields, result in diminished net farm income, further threatening the sustainability of cassava farming and the food security of affected individual farmers (Adisa, 2019, Ajaero, et al., 2021).

The existing literature has examined the effect of farmer-herder conflicts on food security in Nigeria, particularly at the household and community levels. However, there appears to be a gap in research that specifically focuses on the effect of these conflicts on the food security of individual cassava farmers using body mass index and individual diversity score and

econometric tools like multinomial logistic regression and ordered probit. For instance Nnaji et al., (2019) examined household-level food security on a dimensional level, they used a two-stage predictor substitution model on survey data from 401 rural households to analyze the effects of farmer-herder conflicts on food insecurity in Nigeria. Udo (2021) also employed qualitative methods to gather insights from affected communities and analyze the implications of these conflicts on agricultural production and food security.

Aku (2022); Adetunji (2022), & Udo (2021) used experience-based food security scale measurements for individual food security, while Nnaji et al. (2019) and Yahaya et al. (2020) conducted similar studies using empirical analysis. To the best of my knowledge, the effect and causes of farmers-herders conflicts have not received much research interest especially in the study area. Hence, this research is aimed at identifying the remote and immediate causes of these conflicts between the individual cassava farmer and cattle herders and its effect on the food security of the cassava farmers in Imo State.

1.3. Objectives of the Study

The broad objective is to examine the Effects of Farmer-Herder Conflicts on Food Security of cassava farmers in Imo State, Nigeria. The specific objectives of the study are to:

i. describe the socioeconomic characteristics of the cassava farmers in Imo State;
ii. identify the most remote and immediate causes of farmer-herder conflicts among cassava farmers in the study area.
iii. analyze the effect of conflicts on cassava production and farmer's net income in the study area;
iv. examine the most adopted coping strategies to the conflicts and isolate the factors affecting their choices in managing the conflicts in the study area;
v. assess the food security status of cassava farmers in the area and
vi. analyze the factors that affect food security and the effect of farmer-herder conflicts on food security in the study area.

1.4. Hypotheses of the study:

The following null hypotheses were tested:

$H_{O1:}$ There is no significant relationship between some of the socio-economic characteristics, like age, sex, marital status, farm size, farming experience, farmer's household size, conflict factor, labour, size of farmland damaged by cattle encroachment, and the net farm income of the cassava farmers in the study area.

H_{O2}: farm size, savings, access to credit, extension visit, farming experience, sex, primary occupation, age, membership of cooperative association, non-farm income, farms in different locations, land tenure, value of assets, and years of education do not significantly affect cassava farmers' choice of conflict coping strategies in the study area.

H_{O3}: sex, years of educational attainment, household size, age, farming experience, membership of cooperative society, number of extension contacts per month, access to credit, farmers' net income, land ownership, frequency of farmer-herder conflict, and farm size do not significantly affect the food security of cassava farmers in the study area.

1.5. Justification for the Study

The persistent farmer-herder conflicts in Nigeria, particularly in Imo State, have emerged as a critical threat to agricultural productivity and food security, especially among cassava farmers. Cassava is a staple crop and a major source of income and sustenance for rural households in the region. However, the increasing frequency and intensity of conflicts between farmers and herders have led to disruptions in farming activities, destruction of crops, displacement of farmers, and abandonment of farmlands, all of which undermine food security and rural livelihoods.

Understanding the socioeconomic profile of cassava farmers is essential for identifying vulnerable groups and tailoring interventions that address their specific needs. Socioeconomic factors such as age, education, farm size, and access to resources influence farmers' resilience to conflict and their capacity to recover from shocks.

Pinpointing both remote and immediate causes of these conflicts is crucial for developing effective conflict prevention and resolution strategies. Factors such as competition for land, resource scarcity, and weak institutional frameworks often underlie these disputes, and a clear understanding of these drivers is necessary for sustainable peacebuilding.

The direct effect of conflicts on cassava yields and farmers' incomes has significant implications for household welfare and local economies. Quantifying these effects provides evidence for policymakers and stakeholders to prioritize interventions that can restore productivity and improve livelihoods. Investigating the coping mechanisms adopted by cassava farmers and the factors influencing their choices helps in identifying best practices and gaps in current support systems. This knowledge is vital for designing targeted programs that enhance farmers' adaptive capacities and resilience to conflict.

Evaluating the food security status of cassava farmers offers insights into the extent of vulnerability and the effectiveness of existing food security interventions. It also highlights the broader implications of conflict on community well-being and nutrition.

Understanding the interplay between various determinants of food security and the specific effects of farmer-herder conflicts will enable a comprehensive assessment of the challenges faced by cassava farmers. This analysis will support the formulation of holistic policies that will address both immediate and structural issues affecting food security.

This study is justified by the urgent need to generate empirical evidence that can inform policy decisions, guide resource allocation, and support the development of effective interventions to mitigate the adverse effects of farmer-herder conflicts. By addressing the outlined objectives, the research will contribute to the body of knowledge necessary for achieving sustainable agricultural development, peace, and food security in Imo State and similar contexts across Nigeria. The findings from this study will provide valuable insights for policymakers, agricultural stakeholders, and development practitioners to understand the causes of this conflict, design targeted interventions that will enhance food security, promote sustainable agricultural practices, and improve the well-being of cassava farming communities.

Moreover the study will help to resolve the hindrances that affects the development of effective strategies in addressing herder-farmer conflicts thereby enhancing food security among cassava farmers in the study area.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Literature

2.1.1 Farmers

Farmers (also called agriculturists) engage in agriculture, raising living organisms for food or raw materials. The term therefore applies to people who do some combination of raising field crops, orchards, vineyards, poultry, or other livestock. Based on this broad definition, farmers are both herdsmen who herd or keep livestock like cattle, goats, and sheep, and crop farmers. However, for this work, farmers are the cassava farmers (those who raise field crops) also called small-scale farmers/subsistence cultivators only.

2.1.2 Herders/ Herdsmen

Herders/ herdsmen are people who own or keep herds of animals like goat, sheep, and cattle. However, for the purpose of this work, herdsmen are the cattle herders. In Nigeria, it is predominantly the occupation of the Fulani ethnic group. The Fulani originated from the Senegambia before spreading out into about 20 states which cut across West Africa and the Sahel as well as Western Sudan and Central African Republic (McGregor, 2014). They usually move their herds from one place to another in search of pasture and fresh water. Abbas (2010) points out that climate change and land acquisition by capitalist farmers are reasons Fulani herders move southwards in search of grazing lands, and they often come in conflict with farming communities. While managing the herd and driving cattle, cattle grazing grazing on farmland occur leading to destruction of crops and becoming a source of conflict (Egodike, et al., 2020). They are often armed and visibly move about with weapons (like daggers, machetes, arrows etc.) to protect their livestock. The more disturbing issue about the Herders is that they also block the highways with their cattle, rob and kidnap people, keep them captives in the

bush and demand for ransom. The Herdsmen have also been involved in the rape of young and old women and burning of communities (The Vanguard, 2015).

2.1.3 Concept of Conflict

Conflict according to Sani et al., (2021) refers to a disagreement or clash of interests between two or more parties, it arises due to differences in values, beliefs, interests, goals or needs. Conflict is an activity that takes place between conscious, though not necessarily rational, beings. A conflict is defined in terms of the wants, needs or obligations of the parties involved. These wants may be relatively practical, such as in a conflict overfishing limits, where one would hope negotiation would end in a settlement (Michael, 1992). According to Olanrewaju, (2013), conflict itself is not evil; often times it arises from the process of seeking sustainable progress and satisfaction. It emanates as a result of misunderstanding, man's superiority complex, and failure to compromise and reconcile ideas, beliefs, cultures, and interests. If harnessed, it could serve as a powerful tool for progress. Although conflict is generally regarded as a collision of opposing parties, the concept of conflict has not been consistently defined.

Bruck *et al*., (2019) divided conflict into internal and external conflicts. External conflict refers to interstate incidents (among countries), whereas internal conflict generally implies conflict within a state (for instance, civil war or terrorism) or people-to-people conflict (for instance, ethnic and religious conflicts, common violence, or crime). The Uppsala Conflict Data Program (UCDP, 2022) is the world's leading provider of data on organized violence and armed conflict, it identified three categories of conflicts: state-based armed conflict, non-state conflict, and one-sided violence. The classification is based on the actors involved and the spatial and temporal locators of "battle deaths." State-based conflict covers all conflicts in

which at least one of the parties involved is the government, regardless of whether the conflict is between states or within a state.

Non-state conflicts occur among ethnic groups, clans, religions, and other groups, none of which are government entities. These types of organizations may be formally organized groups, informally organized supporter groups, and/or informally organized identity groups. The third category (one-sided violence) refers to the use of armed force or violent behaviors by the state government and/or non-state formally organized groups, targeting civilians and leading to at least 25 deaths. This type of conflict excludes extrajudicial killings in custody. Martin-Shields and Stojetz (2019) differentiated between four types of conflict: interstate conflict, intrastate conflict, internationalized intrastate conflict, and one-sided violence. Interstate conflict is a traditional type of conflict among countries. Intrastate conflict is an internal conflict between government and non-state groups. If intrastate conflict significantly involves other countries, it is defined as internationalized intrastate conflict (Pettersson & Wallensteen, 2015).

2.1.4 Definition and cost of conflict

Strategic Foresight Group (SFG) (2011) defined cost of conflict as a method which attempts to calculate the price of conflict to the human race. The idea is to examine this cost, not only in terms of the deaths and casualties and the economic costs borne by the people involved, but also the social, developmental, environmental and strategic costs of the conflict. Iheanacho (2016) opined that cost of conflict methodological concept takes into account different costs a conflict generates, including economic, military, environmental, social and political costs. The approach considers direct costs of conflict, for instance human deaths, destruction of land and physical infrastructure; as well as indirect costs which have been impacted on the society, for instance emigration, humiliation, growth of extremism and lack of civil society. It also

examines the neighboring countries involved and assesses the impact on them as well as on the international community. In an attempt to place the cost of conflict in perspective, Beriwan (2015) in a study using accounting method classified cost of conflict into direct and indirect cost. Direct costs, involve the immediate losses associated with cost of conflict and include damaged goods, the value of lives lost, the costs associated with injuries (including lost wages), destroyed structures, damaged properties, military expenditure and reduced short-term commerce. In contrast, indirect cost concern attack-related subsequent losses, such as raised insurance premiums, greater compensation to those at high-risk locations, and costs tied to attack-induced long-run changes in commerce, loss infrastructures development, reduced growth in gross domestic product (GDP), lost FDI, revenue loss, changes in inflation, changes in output, increased unemployment, emigration and reduced tourism.

2.1.5 Farmers-Herders Conflicts

According to Okoro,(2018), the group of men who own and rear herds of animals like cattle for commercial purposes are called Herdsmen. They usually move their herds from one place to another in search of pasture and fresh water. It is predominantly the occupation of the Fulani ethnic group in Nigeria. Fulani herdsmen or Fulani pastoralists are nomadic or semi nomadic herders whose primary occupation is raising livestock. The Fulani originated from the Senegambia before spreading out into about 20 states which cut across West Africa and the Sahel as well as western Sudan and Central African Republic (McGregor, 2014). The people are found in large number in Nigeria but while some have moved into the cities, many are still living as semi nomadic herders. They are often armed and visibly move about with weapons (like daggers, machetes, arrows etc) to protect their livestock. The more disturbing issue about the Herdsmen is that they also block the highways with their cattle, rob and kidnap people, keep them captives in the bush and demand for ransom. The Herdsmen have also been involved

in the rape of old and young women and burning of communities (Okoro, 2018). Due to their violent nature and associated killings, the group was recently described as the world's fourth deadliest militant group (Mikailu, 2016).

Herdsmen-Farmers conflict is as old as the existence of man. Okoro (2018) averred that herdsmen-farmer or harder-farmer conflicts occur between small-scale farmers or subsistence cultivators and nomadic or transhumant livestock keepers. Farmer-herder conflicts as comprising different types of conflicts, including ethnic conflicts, interest conflicts, resource disputes, political action, evictions, killings, cattle raiding and cattle rustling.

2.1.6 Methods of conflicts resolution

The herder-farmers conflict has led to nation-wide insecurity, which is a great setback in the fight against food insecurity. The conflicts between herdsmen and farmers in Nigeria are not new and some government interventions are no longer sustainable due to high population growth, land use change, and ethno-religious sentiments, amongst other factors. One of the major government interventions was the establishment of grazing reserves. In January 2019, the Federal government introduced the RUGA project aimed at revitalizing the national grazing reserves under the National Livestock Transformation Plan, but the idea was widely criticized as a land grabbing attempt. Against this backdrop, it is imperative to develop novel approaches that would help to move the conflict from zero-sum to win-win. Such novel approaches according to are Luqman, (2021) are;

i. **Promoting climate-smart agriculture:** Promoting sustainable nutrient cycle whereby herders supply animal manure to farmers in exchange for crop residues can help in soil nutrient restoration. One of the key drivers of these conflicts is climate change and soil degradation, this forces herders to migrate from the north to the south in search for greener

pastures. The impact is less herbage are available for grazing. Hence, with the exchange of manure for crop residues, the herdsmen and farmers can cooperate thereby moving the conflict from zero-sum to win-win.

ii. **Feed preservation and storage:** Training herdsmen on local feed preservation techniques such as silage and hay would make a significant contribution towards seasonal dependency on feeds supply. It would further reduce the need for seasonal migration. Feed supply is generally not a problem during the rainy season. The excess herbage can be harvested, processed and stored against the dry season. Private investors can also tap into the business of feed manufacturing for ruminants. The poultry and aquaculture sub-sectors have well-established feed manufacturing companies and a lot of brands, but the ruminant sub-sector does not (Luqman, 2021).

iii. **The establishment of a community-based educational system using their local language**: The herders and their families do not have access to quality education for proper integration into the society. Presently, they reside in remote areas and only come to town to graze their animals or sell their milk. Consequently, they have less interaction with people of other ethnicities. However, if their children were enrolled into formal education they would learn intercultural communication strategies. Likewise, they can be introduced to innovative livestock production systems that are environmentally sound, economically viable and socially acceptable. The government could provide incentives for those that will enroll their children in schools; for example, subsidized veterinary services, and premium prices for their milk (Luqman, 2021).

iv. **The use of animal trackers:** There are different types of animal trackers that herdsmen can use for effective monitoring of their animals during grazing. Since farmers are complaining about animals grazing on their crops, with these trackers, herders can prevent

their animals from eating farmers' crops. In addition, it would protect the animals from cattle rustlers and proper record keeping (Luqman, 2021).

v. **Development of a database for cattle owners in Nigeria:** The government should develop a database containing the biometrics of farmers and cattle owners in Nigeria. Farmers and herders should have a unique identification number for proper referencing and data-driven policies. The data can be generated using mobile phones or through the use of a register at the local government authority. Whenever a herder enters a community, he should document his presence at the local government authority and also sign out when leaving. In this manner, offenders can be tracked and prosecuted (Luqman, 2021).

2.1.7 Concept of Food Security

Food security means 'access by all people to enough food to live a healthy and productive life'. People that are food secure do not have to live in hunger or have the fear of starvation (Baumann, and Kuemmerle, 2016). Food insecurity, on the other hand, refers to the lack of access to enough food for an active, healthy life. In the world, not all households are food secure, and food insecurity is a persistent problem (UN, 1975) (Adams, Grummer-Strawn, & Chavez, 2003). Some factors play a pivotal role in causing food insecurity, including poverty, low income, lack of education, high food prices, high unemployment rates, scarce property rights, and partial access to markets (Lampietti, Michaels, Magnan, McCalla, Saade, & Khouri, 2011). At the World Food Summit in 1996 this definition was revised and further extended and now included the nutritional value, counting in clean water and sanitation to get nutritional well-being and food preferences. Food preference means that the food taken is acceptable under cultural, ethical, and religious values. The definition until today is that 'Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy

life' (World Food Summit, 1996). According to that definition, the concept of food security is applied on three dimensions: Food availability, access, and utilization. Food availability focuses on the national level, food access on the farming household level, and food utilization on the individual level. In 2009, on the World Summit on Food Security, the definition was revised for the last time so far: A fourth dimension, the food stability, was added (FAO, 2009). Food stability focuses on the function of all three other dimensions.

According to Mason (2002) food security states that when everyone has physical and economic access to enough, nutritious, and safe food to suit their food choices and dietary needs for a healthy life. Food security involves various factors like suitable food choices, fair prices, advancement in food safety, accessibility to open as well as competitive markets, healthy diets, and a more sustainable food supply chain (Armghan, Niaz, Saeed, Afzaal, Islam, & Hussain, 2022). Food security is a combination of various problems interlinked with food utilization, accessibility, and availability (Martins-Shields & Stojetz, 2019). Various other issues like water pollution, economic collapse, currency fluctuations, HIV-AIDS, climate change, trade contracts, and political conflicts affect these factors. In the context of cassava farmers, these conflicts can disrupt agricultural activities, leading to reduced productivity and food insecurity. The challenges faced by cassava farmers in regions affected by farmer-herder conflicts include land insecurity, crop damage, and displacement, all of which directly impact food production and access to food. The need for sustainable policies that promote peaceful coexistence and address the root causes of these conflicts is crucial to ensure the food security of cassava farmers and other agricultural producers. Farmer-herder conflicts directly affect these dimensions of food security by disrupting agricultural activities, causing displacement, and creating an environment of insecurity that hinders food production and access. Addressing these conflicts requires a holistic approach that considers the socio-economic and environmental factors contributing to the tensions between farmers and herders. Resolving

these conflicts and promoting sustainable farming practices are essential steps toward ensuring food security for cassava farmers and rural communities in regions affected by such conflicts.

2.1.8 Food Security Measures

In order to provide a comprehensive framework for designing polices, food security can be measured at the global, regional, national level, household level or individual level. The concept of food security has long been determined from a global and national perspective and it is swiftly moving to farming household and individual assessment. Today the assessment of food security also at the individual livelihood level, meaning that it has shifted from the objective perception to a subjective perception.

There are five commonly used methods that can be used to assess food security identified by FAO (2007) which are : i) the Food and Agriculture Organization (FAO) method for estimating calories available *per capita* at the national level; ii) household income and expenditure surveys; iii) individual's dietary intake; iv) anthropometry; and v) food insecurity experience scale.

1. The FAO method

This method estimates calories *per capita* at the country level using Food Balance Sheets and energy intake variance data derived from household income and expenditure surveys. Countries need the following information to be able to apply this method: i) total calories available in year of interest; ii) number of people living in country in year of interest; iii) coefficient of variation of caloric intake to generate the energy intake distribution curve; iv) cut-off point to estimate the proportion of the population falling under the minimum *per capita* average caloric requirement but this will not be adopted in this work (FAO, 2007).

Advantages

The main advantages of this method is that the estimates are frequently updated thus allowing the national, regional, and global food insecurity trends across time to be examined and compared

Disadvantages

The FAO method has several limitations including: i) dietary quality is not taken into account; ii) the national average *per capita* caloric intake does not allow for understanding the intra-country caloric distribution as a function of household characteristics; iii) method assumes that caloric consumption above minimum caloric threshold indicates food security, when in fact obesity has become a problem among the poor with excessive caloric consumption being associated with mild to moderate levels of food insecurity4; iv) high degree of measurement error in numerator (balance sheets provide data on the amount of calories available but not necessarily consumed) and denominator (i.e., number of inhabitants living in the country in the year of origin). Overall, the origin of data used by countries is sometimes difficult to understand and of questionable validity, and there is little standardization and quality control across countries; v) establishing an average *per capita* caloric requirement cut-off point has several conceptual weaknesses as in reality it is a function of physical activity levels, sex and age, among other factors (FAO, 2007)..

2. Household income and expenditure surveys

This method is based on interviewing respondents in their households. Respondents provide information on the amount of money that they spend on food and other necessities. Different time reference periods have been used including the week(s) or month(s) preceding the survey. The following inputs are needed to be able to take full advantage of this method: i) quantity of

food bought (or expenditures) and costs associated with different foods consumed within and outside the house; ii) foods received by any household member as either a gift or as payment for work, goods or services; iii) foods grown for consumption by household members. This method estimates calories consumed on average per cassava farmer's household member per day, making it essential to have access to culturally appropriate and valid food composition tables (FAO, 2007)..

Advantages

There are several advantages associated with this method: i) it allows for the identification of respondents at risk of food insecurity, thus in addition to mapping from the local to the national level, the determinants and consequence of food insecurity can be examined; ii) it collects dietary quality data that can be taken into account to understand the dimension of the food insecurity construct; iii) it can be used to evaluate national food and nutrition, and anti-poverty programs.

Disadvantages

This method has the following limitations: i) it measures the amount of food available but not necessarily the amount of food consumed within the timeframe of interest, for example, it is quite difficult to measure the amount of food wasted, consumed by guests or fed to household animals; ii) it is difficult to estimate the amount of food consumed outside the household as many people can report how much they spend but have a difficult time reporting accurately the foods consumed outside the household; given the frequent consumption by the majority of the world's population of many different kinds of street foods and fast foods, accurately recalling this information is indeed a daunting task; iii) periodicity in food acquisition can bias the results, for example, it is possible that household members consumed foods that were purchased before the reference period, thus they would be omitted; likewise foods may have

been purchased but may have not been consumed during the period of interest, in this instance these foods would be included in the estimate when in reality they should have not; iv) different countries use different methods for data collection and estimation of key parameters, making it difficult, if not impossible, to compare estimates across countries and regions; v) the conversion of the estimated foods available to the household into caloric intakes involves making major assumptions, thus accepting a high degree of measurement error in the key indicator derived from this method; vi) the method is expensive and requires major input from interdisciplinary teams making it difficult to apply nationally on an annual basis (FAO, 2007).

3. Individual's dietary intake

The individual's dietary intake can be measured through different methods including: i) 24-hour recall; ii) food frequency questionnaires; iii) food records kept by individuals or by an observer. All dietary intake methods need to make use of a reference time frame. Whereas some of the methods rely on the memory of participants (24-hour recall, food frequency questionnaire), others rely on the recording of foods, as they are consumed, by the study participant, an observer. Portion size estimations can rely on assisted memory or foods can actually be weighted before and right after consumption. These portion size estimations are needed to estimate food group counts as well as nutrient intakes, the latter provided that culturally appropriate and valid food composition data bases are available. Lastly, to interpret the nutrient intake findings it is important to have cut-off points for determining the proportion of the sample or population at risk of deficiencies for different nutrients (FAO, 2007).

Advantages

In relationship to the previous methods discussed, dietary intake assessment has some unique, as well as common, advantages: i) it measures food consumption directly and not only food availability; ii) it addresses both dietary quality (macro and micronutrients) and caloric intakes

at the individual level; iii) it allows for mapping from the local to the national level, and the determinants and consequences of food insecurity at the individual level can be examined; this is important for understanding, for example, intra-household food consumption patterns and how it is influenced by sex; iv) different dietary intake methods can be used to understand recent (e.g., 24-hour recall) vs. longer term dietary intake patterns (e.g. food frequency questionnaires).

Disadvantages

By far the methods most commonly used in national dietary intake surveys are the 24-hour recall and the food frequency questionnaire. Both methods rely heavily upon the memory of respondents leading to substantial measurement error even when people are asked to recall what they ate the day before, as in the case of the 24-hour recall. In this instance, respondents also need to recall and accurately report the method of preparation of different meals (e.g. boiling, frying, roasting), spices and other ingredients used and to provide the recipes followed with mixed dishes. The assessment of 24-hour recall portion size estimations is as much an art as a science, as it involves participants recalling not only what they ate, but also how much of it. All of these methodological challenges can lead to an unacceptably high measurement error, especially when interviewers are not fully trained, in order to overcome these challenges already mentioned in using this method for this study, 24-hour recalls were applied in different occasions to the same individuals to be able to have a reasonable estimate of their usual food and nutrient intakes. This is because a single 24-hour recalls cannot meet this need as the intra-subject day-to-day variability in food (and nutrient) intake is very high. In sum, the first major disadvantage of the 24-hour recall and other dietary intake methods is a very high level of measurement error.

The cost of applying 24-hour recalls in national survey is high. Each 24-hour recall takes at least 20 to 30 minutes to apply (depending on the amount of food consumed by the respondent) by a highly trained and experienced interviewer. Likewise, entering the 24 hour-recall data into the software containing the food composition databases needed to convert food intake into nutrient intakes, requires a high level of training and skill.

The nutrient and phytochemical food composition data is usually based on a few samples of each food product and does not take into account the bioavailability of the nutrients in the foods. Nutrient bioavailability is heavily affected by other components in the food matrix, the method of food preparation as well as the individual's health and physiological status. Thus, this becomes another major source of measurement error when estimating nutrient intakes.

Last but not least, estimating the likelihood of nutrient deficiencies relies on cut-off points that are tentative at best, and that are likely to change as more scientific evidence accumulates.

In sum, on the one hand dietary intake methods have important advantages for estimating the risk of food and nutritional insecurity of individuals. On the other hand, applying these methods is very costly, requires very skilled and highly trained personnel, specialized software, and even then, we need to accept a very high level of measurement error and potential misclassification. This is likely to explain, at least in part, why countries have gone for years, and in some instances decades, without conducting national dietary intake surveys (FAO, 2007).

4. Anthropometry

Anthropometry is defined as the measurement of size, weight, body proportions and ultimately the composition of the human body. Anthropometric indicators measure the impact of both food insecurity and health status on the nutritional status of individuals. The anthropometric

indicators most commonly used in national surveys are based on weight and height (or length) of infants, young children, youth and adults. The interpretation of the adequacy of the anthropometric indicators is based on well-established cut-off points was adopted for this work (FAO, 2007).

Advantages

Weight and height measurements are highly standardized and are highly reproducible across individuals doing the anthropometry and across settings. In addition the cost of doing the measurements is relatively low making it a very popular method in national surveys worldwide. The cut-off points used to interpret anthropometric measures are relatively stronger on their evidence-based compared to the cut-off points for establishing the adequacy of nutrient intakes. Anthropometry also allows for mapping nutritional security from the local to the national level and for understanding trends, determinants and consequences of malnutrition at the individual level.

Disadvantages

There are two main limitations when using anthropometric indicators as proxies for food insecurity. First, these indicators are an indirect approximation to food insecurity, as they measure nutritional status which is the result of the interaction between food (in) security and health status. Second, the interpretation of the relationship between food insecurity and obesity is complex, as there is growing evidence that whereas severe food insecurity leads to wasting, mild to moderate food insecurity may lead to obesity. Individuals in this food insecurity category may rely heavily on cheap high-energy low nutrient density foods (FAO, 2007).

5. **Food Insecurity Experience Scale (FIES)**

Food Insecurity Experience Scale (FIES) is experience-based measures of household or individual food security. The FIES Survey Module (FIES-SM) consists of eight questions regarding people's access to adequate food, and can be easily integrated into various types of population surveys The FIES-SM questions refer to the experiences of the individual respondent or of the respondent's household as a whole.

But for the purpose of this work, it will look at the measurement of food security was measured based on the individual level using the anthropometry indicators like the height, weight, and body mass index (BMI) of the cassava farmers as well as individual dietary diversity score. The dimension captured in this way is the food utilization and accessibility dimension (FAO, 2007).

2.1.9 Conflicts and Agricultural Food Production

Agricultural production determines the availability of food; therefore, it plays an important role in ensuring food security. However, the ability of agriculture to ensure food security is not independent of political stability and the sociopolitical environment where agricultural activities take place. This is because the important elements of agriculture, such as labor, large farm size, storage facilities, and markets are subject to political stability (Foods and Agriculture Organization (FAO), 2021; Liefert et al., 2019; Pawlak & Kołodziejczak, 2020). It is observed that where there is unrest, economic activity is likely to be paralyzed, and production and trade flow are disrupted because farmers, traders, and other residents tend to abandon their farmlands for safety. Consequently, farm sizes will shrink as weeds take over since they are not cultivated for a period. Due to the barriers to the free flow of transportation amidst social conflicts, it becomes riskier to transport goods and services in regions affected by terrorism. The consequence is the increased cost of transportation or disruption of food flows to other parts of

the country (Liefert & Liefert, 2015). In this work, the concept of conflicts and how it affects agricultural food production was adopted given that the perceived challenges faced by cassava farmers in regions affected by farmer-herder conflicts include land insecurity, crop damage, and displacement, all of which directly affect food production and access to food.

2.1.10 Conflicts and Food Security

The FAO (2017) has asserted that conflict affected countries have on average higher rates of food insecure people than countries not affected by conflict. Conflicts can have short-term effects on people's nutritional status. This in turn can have long lasting impacts on their livelihoods. There are several ways where conflict affects food security. However at first, it has to be mentioned that the effect conflict has on food security depends on what kind of conflict it is (Martin-Shields and Stojetz, 2019).

Literature shows that conflict often occurs in rural areas, areas that have a lot of agricultural activities (FAO, 2017). Consequently, conflict impacts on agricultural production, food production can decrease considerably, cultivation of food crops are interrupted, where people depend on agriculture and farmlands are ruined by bombs, or unsafe to work on them (Baumann and Kuemmerle, 2016). Farmers on the other hand abandoned their farmlands for the fear of being killed. This can lead to a labor shortage and therefore fewer people harvesting which then can lead to crop yield loss and food insecurity (Eklund, et al.: 2016; Adelaja and George, 2019). The concept of conflict and food security was adopted because the perceived result of conflicts, will lead to a reduction in food production which lead to a decline in food availability and then cause a reduction in market access to buyers. Conflict can also lead to people fleeing and as noted, they are especially vulnerable to food insecurity. This concept suggests that farmer-herder conflicts negatively affect the availability, access, and stability dimensions of food security for cassava farmers through reduced production, income, and resource access.

Addressing the root causes of these conflicts is crucial for improving the food security of cassava farmers in Imo State, hence the motivation to carry out this research.

2.1.11 Conflicts and Economic Development

The literature on the economic costs of conflict is conclusive; conflicts harm economic development. The effects on economic productivity is very severe as it causes devastation of cities and infrastructures, interrupts economic activities, discouraging investors, and curtails government spending, and hence economic growth. During violent events, citizens usually face a trade-off between welfare and security. Several empirical analyses have highlighted the impact of conflicts on human development, particularly on education, health, and labor market outcomes (Brück et al., 2019).

Given these large costs, it is imperative to prevent the occurrence of conflicts. As earlier literature has shown, several economic and structural factors, such as low-income levels, poor growth outcomes, weak state capacity, and inequality of opportunity especially across ethnic, religious, and regional groups are associated with a higher likelihood of conflict. Addressing these challenges will help to prevent conflicts (United Nations and World Bank, 2018). For countries in conflict, efforts should focus on limiting the loss of human and physical capital, including by protecting social and development spending, and on trying to maintain well-functioning institutions to lessen the harmful long-term economic effects of conflict.

2.2 Theoretical Literature Review

2.2.1 Theory of Cost

Hall and Hitch propounded the theory of cost in 1939. They use the cost theory to provide a framework for understanding how companies and individuals allocate their resources in order to keep costs low and profits high. Costs are very important in making business decisions. The

cost of production provides a floor for the determination of prices. It helps managers make correct decisions, such as what price to quote, whether or not to place a particular order to buy or supplies, whether to withdraw or add a product to the existing product line, and so on.

Cost theory uses different cost indicators, such as fixed and variable.

i. Fixed costs (FC), do not vary with the quantity of goods produced. An example of a fixed cost would be the rent of a place.

ii. Variable costs (VC), change according to the quantity produced. For example, if to increase production it is necessary to hire additional workers, then the wages of these workers are variable costs.

The sum resulting from fixed costs and variable costs is the total cost (TC) obtained.

TC = FC + V C.

Cost theory has other indicators:

(i) Average total cost (ATC). The total cost divided by the amount of goods produced.

ATC = TC / Q

ATC= Average total cost

TC = Total cost

Q = Quantity

(ii) Marginal cost (MC). The increase in the total cost resulting from increasing production by one unit. MC = ΔTC/ΔQ

ΔTC = change in total cost

ΔQ = change in quantity

Under cost theory, as long as marginal revenue exceeds marginal cost, the increase in production will increase profitability. The theory of costs is applied in a large number of

accounting and management decisions in business management, such as breakeven analysis, degree of operating leverages, business risk analysis etc.

Farmer-herder conflicts can lead to the destruction of cassava farmlands and crops, which increases the costs of production for cassava farmers. Farmers have to invest more resources into protecting their farms and replanting destroyed crops, reducing their profits and ability to reinvest in their farms and because of these reasons the above theory was adopted in this work.

2.2.2 Theory of Production

According to Adegeye *et al.* (1985), production is transforming inputs into output. According to Umeh *et al.* (2013), production is the process whereby some goods and services called inputs are transformed into other goods and services called output. Theory of production describes laws of production (Koutsoyiannis, 1979). The basic theory of production concentrates only on efficient methods since inefficient method will not be used by rational entrepreneurs (Hernderson & Quandt, 2007). In the production of an output, inputs are not combined in a fixed proportion (Koutsoyiannis, 1979). According to Reddy *et al.* (2009), a product or output by definition is an outcome of utilization of resources. Reddy *et al.* (2009) emphasized that resources physically enter the production process to produce output and referred to resources which do not enter physically into production as service. Resources are fixed or variable for a specific period of time (Henderson & Quanta 2007; Reddy *et al.*, 2009).

Henderson and Quandt (2007), specified that fixed input is necessary for production but its quantity is invariant with reference to the quantity of output produced and that its costs are incurred by the entrepreneur regard less of his short run maximization decision. Fixed resources remain in unchanged irrespective of level of production.

Theory of production can be related to the effect of farmers-herders conflicts on the food security of cassava farmers through the lens of resource allocation and efficiency. Farmer-

herder conflicts disrupt the production process by damaging cassava farms and displacing farmers. This may lead to inefficiencies in resource utilization, affecting cassava output and food security.

2.2.3 Conflict Theory

The incidence of conflicts causes uncertainty and anxiety, leading farmers to make less efficient production decisions. Farmers may shift away from high-investment activities like cassava cultivation to lower-yield seasonal crops, reducing cassava production and availability. The theory of conflicts will help us to understand the root causes of this conflicts and its mitigations. The contemporary society is characterized by different schools of thought, each analyzing social phenomenon from its own orientation. For the purpose of this study, the conflict theory is adopted to explain herders-farmers conflicts in Ondo and Oyo state, Southwest Nigeria. In its general application, the word or term conflict connotes view of difference and disagreement, strife and struggle. In essence, conflict theory was derived from the ideas of Karl Marx (1818-1883) the great German sociologist, theorist and political activist who believed that society is a dynamic entity constantly undergoing change driven by inter-conflicting principles and phenomena. According to Marx, men, in the social production of their existence, inevitably enter into definite relations which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production the totality of which constitutes the economic structure of society.

The fact that the dominant or ruling class (the bourgeoisie) controls the social relations of production, the dominant ideology in capitalist society is that of the ruling class. Ideology and social institutions, in turn, serve to reproduce and perpetuate the economic class structure, According to Marx, the real foundation upon which the superstructure of social, political and intellectual consciousness was built, has been the exploitative economic arrangements of

capitalism. Marx believes that any social setting based on exploitative economic arrangement generated within it the seed of its own destruction (Omer & Jabeen, 2016).

In general, conflict perspective view Society as made up of individuals competing for limited resources. Competition over scarce resources is at the heart of all social relationships. Competition, rather than consensus, is characteristic of human relationships. Broader social structures and organizations reflect the competition for resources and the inherent inequality competition entails, some people and organizations have more resources (i.e., power and influence), and use those resources to maintain their positions of power in the society (Omer & Jabeen, 2016), in conflict over resources, and that conflict drives social change. For example, conflict theorists might explain the civil rights movements of the 1960s by studying how activists challenged the racially unequal distribution of political power and economic resources. As in this example, conflict theorists generally see social change as abrupt, even revolutionary, rather than incremental. In the conflict perspective, change comes about through conflict between competing interests, not consensus or adaptation. Conflict theory, therefore, gives sociologists a framework for explaining social change. All conflicts share common qualities. The first is that there is a kind of contact between the parties that are involved, secondly, the parties in conflict perceive conflicting views and finally, one of the parties always wants to redress existing contradictions (Abbas, 2018). The theory of conflict can be related to the effect of farmers-herders conflicts on the food security of cassava farmers by highlighting the underlying causes and dynamics of these conflicts. The escalation of conflicts due to environmental factors like climate change further intensifies the struggle for resources, exacerbating food insecurity for cassava farmers.

2.2.4 Coping Theory

The ability of cassava farmers to cope with the risks and effects of farmer-herder conflicts is a key determinant of the effect on their food security. Addressing the underlying causes of these conflicts and supporting effective coping strategies are crucial for improving the food security of these farmers. The coping theory of Folkman and Lazarus (1980 cited in Appiah-Boateng et al. 2022) was used to gain a better understanding of farmers' and herders' exposure to the differences in the farmer-herder conflict in the Asante Akyem North District as well as their coping techniques. According to Appiah-Boateng and Bukari (2022) theory of coping, coping is more than just a reaction to stress. Rather, an individual's cognitive assessment of an experience determines to cope, and one's cognitive assessment influences emotional arousal as a result Appiah-Boateng and Bukari (2022).

Psychological stress, according to Appiah-Boateng and Bukari (2022), is a relationship between a person and their environment that is assessed as potentially damaging to their well-being. This person-environment interaction is mediated by two important processes: (a) cognitive appraisal, which is an evaluative process that determines why and to what extent a specific transaction between a person and their environment is stressful; and (b) coping, which is the process by which an individual manages the demands of the person-environment relationship and the resulting emotions. The relationship between cognition, coping, emotion, and a person's fit to their circumstances was defined by Appiah-Boateng and Bukari (2022). They also take a cognitive approach to how we interact with our environment, emphasizing the process as a mental appraisal (Appiah-Boateng and Bukari (2022).

Coping is viewed as a collection of tactics that may be used in a variety of situations. When it is determined that there is nothing that can be done to change the hurtful, threatening, or challenging environmental situations, emotion-focused coping is most likely to occur. This

type of coping aims to change an individual's emotional response to a problem and includes techniques such as wishful thinking, reduction, and avoidance. Problem-focused coping processes, on the other hand, have a direct effect on the stressor. Some coping strategies, such as seeking social support, can help with both emotions and problems (Appiah-Boateng and Bukari (2022)). Most people utilize both emotion- and problem-focused types of coping in response to stressful experiences (Appiah-Boateng and Bukari (2022)). Victims of conflicts gather a number of resources to deal with stressors that originate internally or externally. The resources used to address these stressors may stem from the mind, thoughts, and behaviors. These stressors may be actual or imagined and have consequences on the actions of the victim. Several scholars have explored coping strategies in violent situations and found a variety of such strategies adopted to deal with the stressors (see the works of (Appiah-Boateng and Bukari, 2022). In a study by Appiah-Boateng and Bukari (2022) on how a person's religious background affects individual's coping strategies on the effects of conflict, the authors found that individuals adjusted better with a positive religious outlook. This positive religious outlook according to the authors includes forgiveness, collaboration, benevolence, and spiritual connections and support than those with negative religious outlook. Religion is one main form of emotional support for victims (Appiah-Boateng and Bukari (2022)). The outcomes of religious coping strategies may either mar or improve the mental health of the victim (Appiah-Boateng and Bukari (2022). In addition to religion, some victims of violence resort to migration for security and greener pastures (Appiah-Boateng and Bukari (2022). Other victims of violence resort to social support networks for relief (Appiah-Boateng and Bukari (2022) and/or work harder as an economic strategy (Appiah-Boateng and Bukari (2022). All these factors have had the ultimate effect of bringing relief to the individual involved.

2.2.5 Frustration Aggression Theory

Frustration aggression theory also known as the 'frustration–aggression–displacement theory', is a theory of aggression proposed by John Dollard, Neal Miller, Leonard Doob, Orval Mowrer and Robert Sears in 1939 and further developed by Neal Miller in 1941and Leonard Berkowitz in 1961. The theory says that aggression is the result of blocking, or frustrating, a person's efforts to attain a goal (Friedman and Schustack, 2014). When first formulated, the hypothesis stated that frustration always precedes aggression, and aggression is the sure consequence of frustration. Two years later, however, Millerand Sears re-formulated the hypothesis to suggest that while frustration creates a need to respond, some form of aggression is one possible outcome. Therefore, the re-formulated hypothesis stated that while frustration prompts a behavior that may or may not be aggressive, any aggressive behavior is the result of frustration, making frustration not sufficient, but a necessary condition for aggression (Zillmann Dolf, 1979). It attempts to give an explanation as to the cause of violence. Frustration is the "condition which exists when a goal-response suffers interference", while aggression is defined as "an act whose goal-response is injury to an organism (or an organism surrogate).

The theory says that frustration causes aggression, but when the source of the frustration cannot be challenged, the aggression gets displaced onto an innocent target (scapegoat). This theory is also used to explain riots and revolutions, which both are believed to be caused by poorer and more deprived sections of society who may express their bottled up frustration and anger through violence (wordpress.com, 2012). According to Olu-Adeyemi (2017), a number of other variables influence the use of violence as well, for example the culture, the society, and the political environment. The culture must at least accept, if not approve, violent action

as a means to an end. Violence is also more likely if the current leadership and/or the socioeconomic/political system is seen as unresponsive.

Olu- Adeyemi also asserted that the central theme of the theory is that scarcity is the product of insufficient supply (impact of climate population explosion) or unequal distribution of resource as a result of deprivation which ultimately leads to aggression. On the issue of frustration, it means that one's access to means of livelihood (farming or grazing as the case may be) is being thwarted by another or possibly by particular circumstances and that one's reaction to this thwarting is that of annoyance. Olu-Adeyemi also added that, deprivation is not based on wants or needs alone, but on the wants and needs that we feel we ought to have or deserve. More often than not, the Herdsmen are frustrated due to desertification, thus, the reality is that they face forced migration and as they migrate, series of challenges are encountered which in turn brings frustration. Similarly, farmers who have struggled to cultivate farmlands also get frustrated whenever herds of cattle destroy their farmlands. The Fulani Herdsmen terror is a struggle over values and claims to scarce resources in which their aims are to neutralize, injure or to eliminate the host communities in a bid to fend for their animals. The violent activities of the Fulani Herdsmen occur because of the accumulation of residual instigatory effects of frustration. The terrorist activities of the herdsmen are traceable to the desertification that has caused depletion in grazing opportunities or scarcity of feed for their animals which in the long-run affects their economic wellbeing. If a herdsmen losses his flock to drought and water scarcity, he may be frustrated because of the loss of livelihood. From this reality, he may be aggressive and since, he cannot channel it to the natural causes, he may in the long-run channel it to any person or group that obstructs his migration to a safe area. On the side of farmers and host communities in Nigeria frustration also occur whenever animals of the herdsmen trample on their farmlands to eat up their crops. And because they

are frustrated too, they become aggressive and channel their aggression to the herdsmen and their cows. Owing to this reality, conflict and confrontation is inevitable.

2.2.6 Dialectical Materialism

The theory of dialectical materialism lies in the concept of the natural world evolution and emergence of new qualities of being at new stages of evolution. Dialectical materialists postulate that man's consciousness of himself in the society is determined by material condition. Here, material condition refers to what one owns, possesses or what one can advert to, in the society. Central in determining man's material condition are the way the society organizes the production, distribution and exchange of these goods and services that man perceives as his possessions. The theoreticians observe that since these materials are limited, man's aspiration to possess them usually results into conflict with others seeking the same material. Dialectics is thus what the theoreticians call the resultant of this competition, hence the term dialectical materialism.

The dialectical materialists are of the firm position that conflict was inevitable in the absence of equity and justice occasioned by limited resources. Meanwhile, to allay this vicious circle of dialectics in order to ensure harmonious co-existence in the society, the theorists advocate that attempts must be made to ensure equity and justice as sine qua non for progress or development (Shakhnazarov, 1978). However, the theory as expounded here appropriately matches the situation obtainable in the herdsmen and farmers scenario in Nigeria. It is therefore the perception of each group that the other is a threat to its material condition in the society that eventually escalates into violent conflicts between them. Herdsmen sometimes accuse farmers of killing their cattle and resort to attacking or killing the farmers. The farmers on the other hand see herdsmen as land encroachers and crop destroyers, and of course, make efforts to protect their properties (land and crops).

2.2.7 Causes of Incessant Herders Attacks on Crop Farming Communities in Nigeria

The Fulani herders (pastoralists), whose primary occupation is the raising of livestock indulge in random movements across the West African region aimed at reaching areas with abundant grasses and water for their cattle, avoiding tax collectors, harmful insects, hostile weather, and social environment, are often engaged in intense competition for the limited amount of land with farmers who use their land for agricultural purposes. A number of factors have been attributed to those conflicts. Some of the causes may include:

1. **Competition for Scarce Resources**: Competition is the main cause of every conflict. Persistent antagonism over scarce resources is the fundamental cause of conflict between economic agents since all conflicts share common qualities (Ofuoku & Isife, 2009). From the words of Manu et al (2014), conflict originates from the insatiable nature of human wants: competition for scarce resources is the foremost causes of common intergroup conflict. Farmers-herders crisis is basically caused by competition since farmers increasingly compete with Fulani herders for farmland, pastures and water. Conflict of value exists among these two contending causes. Fabiyi & Otunuga (2016) estimated that "Nigeria has 22 million cows that consume about 1 billion gallons per day of water and 500 million kilograms of grass and forage crops. The stock value of Nigeria's cattle population is about N3.4 trillion or $16.3 billion at N150, 000 per head".

2. **Crave for a Greener Pasture for Rearing Cattle**: Shifting weather patterns attributed to climate change has transformed vast tracks of grassland into desert, driving large number of herders southwards. Nformi et al, (2014) assert that environmental issues like desertification, land degradation and climate change are becoming major factors in conflict. Climate change has constituted a great threat by putting great pressure's on the land thus provoking conflict. Climate change has caused desertification in the far north, and has led to extended drought and an estimated 20% drops in crop yields (Fabiyi & Adeleke, 2016). Ojo (2016) maintains that:

Desertification in the savannah region of northern Nigeria, due to low rainfall, has substantially reduced the grazing land and water sources for cattle. Thus, the herdsmen in order to feed their animals have to migrate to where they could get grass to nurture them. In the cause of doing that, the cattle swoop on farmlands and destroy crops planted by farmers. Of course, the farmers have to fight back over the destruction of their means of livelihood. Another environmental factor that influences their movement has to do with the fear of losing the cattle to rustlers, wild animals, and harmful insects (tsetse flies) which cause diseases such as trypanosomiasis. Furthermore, the intensification of Boko Haram terrorist activities over the years has caused nomadic Fulani herdsmen to abandon their foraging grounds in the northeast.

3. **Expansionist Policy and Land Grabbing Agenda**: Most communities in Nigeria, especially in Benue, Plateau, Taraba, and Kaduna States are expressing fears that the Fulani herdsmen's attacks could possibly have a hidden agenda aimed at taking over their land completely and occupying for their economic purpose (Fabiyi & Otunuga, 2016).

4. **Ethno-Religious and Political Factors**: Farmers-herders crisis in Nigeria is seen as resource conflict and takes ethno-religious and political dimensions. Herder and farmer groups have different values, customs, physical and cultural features, differences between them are often tagged as ethnic conflict. Herders are therefore united in the sense that they belong to one ethnic group. This strong sense of belongings (in-group feelings against out-group or farmers) among herders is a unifying force that enables them to organize themselves to protect their economic interest and protect their cultural value as an ethnic group. The Fulani nomadic cattle rearers being a minority in host communities have a unique culture and strange sense of solidarity. They are often isolated from the farming population. In such cases, the conflict between them and the farming population of the host communities is regarded as having an ethnic colour. Conflict between farmers and Fulani herders unite Fulani ethnic group who view an attack on a fellow Fulani as an attack on all. Whenever crisis erupted between Fulani

herdsmen and farmers in Nigeria, those from Niger Republic, Chad, Mali, Senegal, Gambia, Guinea and other West African countries including those living in Cameroon will find their ways to Nigeria to fight the host communities to protect their interest, thus taking ethnic dimensions. This assumption has been validated by the governors of Benue and Kaduna States respectively and the Nigerian military who argues that the violent herdsmen that attack and kill rural farmers, burnt their houses, rape and destroy property are not from Nigeria (Ojo, 2016). The main contention here is that the Fulani herdsmen incessant attacks are viewed by the Christians as an agenda to Islamize Nigeria and to completely takeover their land for political reasons and to further their economic interest. The Fulani herders claim there is freedom of movement of men and cattle, interaction and appreciation in the country while the farmers see the farmland invasion as not acceptable and infringement on their personal and communal property (Idowu, 2017).

5. **Overgrazing:** Overgrazing is a source of conflict between herders and crop farmers. Rural dwellers and farmers often accuse the herdsmen of overgrazing on their lands. Overgrazing causes land degradation, soil erosion and lose of useful species. According to Ofuoku & Isefe (2009), continues overgrazing causes erosion on the plot of land thereby making it infertile and difficult to cultivate by farmers. Overgrazing removes the vegetal cover over the soil and the exposed soil gets compacted due to operative soil depth declines.

6. **Destruction of Crops and Cattle Theft (Rustling):** Destruction of crops by cattle during grazing and cattle theft is one of the major causes of conflict between Fulani herders and crop farmers in Nigeria. 8. Indiscriminate Defecation and Causing of Accidents by Cattle on Roads: Defecation on roads and causing of accidents by cattle when herders are crossing with herds on roads is also a cause of conflict between herders and farmers. It is considered as a minor cause, though (Ofuoke & Isife, 2009). Contamination of Streams and Rivers: In most rural communities, streams and rivers are the main source of water supply. Many communities have

the notion that contamination leads to outbreaks of cholera, typhoid fever, and lever fluke. Ojo (2016) alleged that: When these herdsmen take their cattle to drink at Community Rivers, the water is polluted by the animals and they indiscriminately urinate and defecate in them. Thus, women and children who source water for farmers use are put through a lot of stress seeking clean water for drinking and cooking. Some of these Fulani herdsmen even kidnap, beat up, rape, and murder some of the women that dare to challenge them about the destruction of their farmland or pollution of their water sources.

The causes of incessant herder attacks on crop farming communities can be directly related to the effect of farmers-herders conflicts on the food security of cassava farmers through competition for land resources, environmental degradation, and lack of conflict resolution mechanisms, directly contribute to the destruction of cassava farms, displacement of farmers, and overall instability in farming communities. These factors collectively undermine the food security of cassava farmers, highlighting the need for comprehensive solutions to address the underlying causes of the farmers-herders conflict.

2.3 Empirical Literature Review

2.3.1 Socio-economic Characteristics of the Farmers and Herders

Omoregbee, *et al* (2018) carried out an analysis of cassava Farmer's socio-economic characteristics and their access to agricultural information in Delta State, using descriptive statistics, the results showed that the largest proportion of the respondents (35.6%) was 41 – 50 years, followed by the age group 21 – 30 years (22.6%). Their mean age was 44.8 years, indicating that most were economically active and of productive ages hence there is high prospect for agricultural information accessibility. Data revealed that majority of respondents (43.2%) had a farming household size of 4 – 6 members, followed by those with 7 – 9 members (28.8%), with the mean size being 6. This means that the farming household size of the

respondents was relatively large. The mean farm size was 0.93 ha. A large proportion of the respondents (45.9%) belonged to cooperative society, 13.0% belonged to farmers association, and 5.5% belong to age grade while 35% do not belong to any social group. Above half of the respondents 45.2% had no contact at all with extension workers.

Adelakun, Adurogbangba and Akinbile (2015) examined Socioeconomic Effects of Farmer Pastoralist Conflict on Agricultural Extension Service Delivery in Oyo State, Nigeria. Multistage sampling technique was used to select 60 farmers and 60 pastoralists for the research and was interviewed with structured questionnaire. Results showed that a little above half (52.6%) were between the ages of 30-50 years. The majority (63.3%) had farming household size of 5-9 members. Crop damage (63.3%) and indiscriminate bush burning (46.7%) were considered the most common causes of conflict between farmers and pastoralists. The majority (71%) of farmers suffer economic losses from farmer-pastoralist conflicts. About seventy five percent of farmers used more of problem-oriented (e.g. early harvesting/stock disposal) coping strategies while the majority of herdsmen (73%) used more of emotion-oriented strategies (e.g. use of charms/Vengeance. There was a significant difference (p=0.000) in socioeconomic losses among farmers and pastoralists. Farmers are the worst hit of Farmer pastoralist conflicts as it affects their family farming. Setting up of a three-tier farmer herdsmen conflict management committee is recommended.

Gamgum, (2018) in his study assessed resource use conflict between Farmers and Fulani Herdsmen in Guma Local Government Area of Benue State. The data collected comprised socio-economic characteristics of Farmers and Herdsmen, causes and effects of the conflict. The study revealed that, both farmers (AI=1.93) and herdsmen (AI=1.55) agreed that herdsmen were not accepted by their host communities. The role of traditional rulers (CCI=3.68), destruction of crops/farmland (CCI=3.21), contamination of water (CCI=3.45) and harassment

of herdsmen by host communities (CCI=3.25) were the major causes of conflict between farmers and herdsmen. Displacement of both farmers and herdsmen (CEI=3.67), loss of lives and properties (CEI=3.49), and decrease in output (CEI=3.48) were the major effects of conflicts between farmers and herdsmen in the area. The paper concluded that the conflict is a setback to the development of agricultural sector and therefore recommends the creation of grazing reserves so that herders can shift from traditional method of animal husbandry to modern methods.

2.3.2 Empirical Review on Institutional, Environmental Factors Influencing Farmer-Herder Conflicts on Food Security

The attacks on cassava farmers and attacks on the herders causes food insecurity, lead to dependent poverty (absolute or primary poverty) situation and more social instability as well as political damage. The government's hardiness to put a stop to the armed Fulani herdsmen atrocities has created a situation in which farmers are unable to harvest what is left on their ravaged farms because they are neither in refugee camps nor are on the run for their lives. Most of them are also not planning for the season. With millions of farmers not harvesting now and not planting for the next season, famine was very imminent in many Nigerian communities including urban areas because most of these crops are harvested and taken to urban centers where they are consumed. Incessant killings have very serious implications on the social stability of the country as people are always afraid of going about their business activities, schools are closed down, and many infrastructural facilities including houses are destroyed. The overall effects of farmer-herder violence in Nigeria have disastrous implications both on socio-economic development, political and religious aspects. Ofuoku & Isife (2009) pointed out that the crisis tends to negatively affect savings, credit repayment ability, as well as food security and economic wellbeing of urban dwellers that depend on these farmers for food

supply and this discourages the farmers and rural agricultural development. The attacks by the herdsmen on farmers may affect the more the efforts of the present government to diversify the Nigerian economy which is centered on agriculture due to unstable oil prizes in the international market. This violence disrupts farming activities, reduce crop yields and retard the efforts at modernizing Nigeria's agricultural sector. This agricultural low output may result in malnutrition and diseases.

Alina (2020) investigated on the environmental determinants of a country's food security in short-term and long-term perspectives. The results showed that the influence of environmental (ecological) factors on a country's food security in short- and long-run perspectives allows the confirmation of trends and cohesions identified by other scientists. An increase of the factor by a point results in the strengthening of a country's food security by 0.0105 in the long run. In addition, our empirical results about the impact of access to electricity in rural areas on food security also correlate with the FAO's findings that electricity is necessary at each stage of foodstuff production. Moreover, access to electricity in rural areas might become a driver of agricultural productivity, efficiency, and food security. In addition, the prohibition of cutting trees (forest areas) has a positive influence on farmers food security.

Moreover, Wambua, Omoke, and Telesia (2014) also revealed that using animal manure or industrial fertilizers allows an increase in agricultural crops. Hence, the authors pointed out that households using fertilizers for agricultural issues did not face the problem of food insecurity even in periods of unfavorable weather and climate conditions. It was revealed that CO2 emissions have a negative influence on a country's food security, as was also highlighted in other research by Sibanda and Ndlela (2020).

2.3.3 Empirical Studies on Determinants of Food Security

A number of different studies have examined determinants of food security in both developed and developing country contexts. These studies have used varied proxies for food security and different measures of fertility. Indeed, given the multidimensional nature of food security, there is no single indicator that is considered sufficient to measure all aspects of food insecurity and as such, there is currently no gold standard tool in existence. Workicho et al. (2016) examined predictors of farming household dietary diversity in Ethiopia using a representative sample and found that households with greater than four members were associated with better dietary quality and nutritional scores. The framework for household dietary diversity involves assessing the variety of foods consumed to reflect access to a range of nutrients and overall diet quality. It is operationalized through a dietary diversity score, calculated based on the consumption of different food groups within a specified period, often 24 hours. The score indicates the economic ability of a household to access diverse foods, with higher scores correlating with improved nutrient adequacy and food security. Data collection is typically done through surveys focusing on household consumption, with questions directed at the person responsible for food preparation. The framework emphasizes the importance of understanding factors influencing dietary diversity, such as nutritional knowledge, attitudes, and socio-demographic characteristics, to enhance overall household nutrition well-being

Powell et al., (2017) conducted qualitative surveys on small-scale agricultural communities in Tanzania and found that while a number of respondents noted large family sizes as a potential obstacle to achieving dietary diversity and food security, other survey respondents argued that larger family sizes may increase dietary diversity. This is because it is more difficult to get enough of any one type of food to feed a large family. Farzana et al., (2017) also found that in

Bangladesh and Nigeria, respectively, larger households were more food insecure compared to those with small numbers of households.

The use of a single measure of food security was emphasized by the researchers themselves as a serious limitation of their study, given that reduced coping strategy findings may be context or setting specific. This indicator should therefore be validated against other indicators such as food consumption (household, individual), poverty measures (income and expenditure) and individual health and nutritional status; a caution that is repeated by several other researchers.

Despite the prevalence of studies on farming household food security, fewer studies have attempted to examine food security using individual-level measures. Indeed, food security is best considered individually, since different members of the same households can experience different outcomes based on sex, age, culture or other factors (Owoo 2018). This study looked at food security of cassava farmers at the individual level.

Theoretical Approaches towards food security. With respect to the theoretical approaches to food security, there are three theories developed in 1970s and 1980s as cause to food insecurity. The first one is Climate theory; this theory explains food insecurity as caused by climatic phenomena. Cox, related this theory with the concept of "famine belt" in which he directly links climate condition to food insecurity. This theory argued that in the national or local level, climate linked phenomena such as drought, floods and others are a major factor causing food insecurity (Cox, 1981, cited in Steven Engler, 2014)

The proponents of this theory argued that food scarcity occurs when the availability of food is less than the food necessity of the population. The primary developers of this approach were Adam Smith and Malthus who argued that famines are primarily caused by a sudden decline in food availability. They consider natural drivers as the main causes for food insecurity and analyses their influence on harvest failures and advances in prices. They are supply-oriented,

in this sense, the Food Availability Decline theory differs from the climate theory. Food availability decline theory is vulnerable to criticism because it is confined to food availability at local levels instead of including assessments on food availability at aggregate or macro levels. They argued that crop failures due to natural disasters often result in high food prices, and increased demand to deal with uncertainties. The decline in purchasing power affects the poor and those who are in trouble by bad weather to become food insecure (Lin and Yang 2000, cited in Galunde.)

"Food entitlement decline theory" has been criticized for its focus only on the economic aspect of famine and its failure to recognize the social and political aspect. First, he fails to recognize individuals as socially embedded members of households, communities, and states. Second, he fails to recognize that famine is caused by political crisis as much as it is the result of economic shocks or natural disasters (Devereux, 2001). Those scholars who criticized Sen argue that importing food in a situation of existing insecurity could be the answer to minimize the food problem and to save lives (Steven Engler, et al, 2014)

Olagunju et al. (2016) used the food security index, surplus/shortfall index and a probit model to determine factors influencing the food security status of customers of the Nigerian Bank of Agriculture (BOA), it was reported that households income is one of the factors that affected food security status of the households, households with low income cannot afford adequate food requirement for their households.

Similarly, Ubokudom et al. (2017) determined the food security status of 343 food crop farmers' households in Akwa-Ibom, Nigeria, using the food security index approach. It was concluded that educating household members, making fertilizers available to farmers at a subsidized rate, controlling birth rates, and disseminating information related to soil conservation practices to farmers would reduce food insecurity problems in the area.

2.3.4 Empirical review on management strategies to farmer-herder conflict.

Akinyemi and Olaniyan, (2017) on climate war. Migratory adaptation and farmer-herder conflicts, they reported that the effectiveness of conflict mediation systems in ensuring just and adequate mediation in conflict situations plays an important role in preventing the escalation of violent conflict among groups. The result showed that, a high number of affected farmers (30%) rely on self-help or self-defense measures. This is surpassed only by recourse to traditional authority which was preferred by 37.5% of the farmers. There is no doubt that self-help approaches that are not mediated by neutral and impartial adjudicators open the space to unpredictable outcomes including violence and subsequent counter-attacks. The preference for traditional authorities is apparently due to the perception of relative ownership of the system by the aggrieved farmers hence a higher level of trust regarding its perceived attributes including the sanctity and integrity of traditional adjudication, sensitivity to context, neutrality and effectiveness of traditional conflict mediators, most of whom are also farmers. The influence of traditional authority is significant in that most of the conflicts are settled at the local level and rarely extends to the attention of state administrative authorities except where conflicts have escalated into major violence. Perceived failure to do justice at this level, however, leads to a breakdown of confidence. The popularity of this institution notwithstanding, there is a notable decline in its effectiveness. This, according to Baca (2015) is a consequence of the changing political economy of power in the country. A major effect of this transformation is emergence of formal leadership at the local level. When aggregated, the data obtained shows that 67.5% preferred third party mediation when contestation arose as against 35% which resorted to self-defense (30%) or did nothing (5%). This shows that institutions both at the traditional and formal levels still play important roles in conflict prevention and management. This institutional mediation factor is also seen in the variations in the propensity to violence in each of the areas examined. F2 or example, farmers in

both Ekiti (Efon Alaaye) and Kwara (Oke-Ero) recorded high indicators in the resort to third party mediation with 80% and 70% respectively. Correspondingly, both states (Ekiti and Kwara) also recorded low indicators on resort to self-help with 10% and 30% respectively. The high score recorded for institutional mediations also raises question about the effectiveness of such interventions as a popular option in conflict mediation among the population. Effectiveness determines the level of community confidence in the mediating institution, as well as the credibility of outcomes. It is the combined effects of these that reduced people's inclination to resort to self-help and violence, thereby preventing the escalation.

2.3.5 Empirical review on effect of conflict on food security

Empirical studies consistently demonstrate that conflicts in Nigeria, including Boko Haram insurgency, farmer-herder clashes, and banditry, severely undermine food security by disrupting agricultural production, displacing populations, and destabilizing markets (Asaju & Kwakano, 2025). These effects manifest across the four pillars of food security—availability, accessibility, utilization, and stability—with violence leading to farmland abandonment, crop destruction, and reduced yields, particularly in northern and Middle Belt regions (Asaju, & Kwakano, 2025; Yisa, et al. 2024). Research spanning 2016–2025 highlights a cyclical relationship where insecurity exacerbates poverty and malnutrition, while food shortages fuel further tensions (George, et al., 2022).

In northeastern states like Borno, Adamawa, and Yobe, Boko Haram has displaced millions, destroyed farmlands and livestock, and halted farming activities, causing sharp declines in staple crops such as maize, millet, sorghum, and rice (Asaju, & Kwakano, 2025; Bello, 2024) A study in Adamawa found that terrorist activities reduced farmer productivity, with crop outputs dropping from pre-insurgency levels (e.g., 1,100–2,000 kg for various crops) to minimal yields during peak violence, leading to household calorie intakes below security thresholds (e.g., 963–1,003 kcal/day) (Bello, 2024). Market closures and border restrictions

further limit food distribution, increasing prices and dependence on aid, with women and children facing heightened malnutrition risks (Asaju, & Kwakano, 2025).

Farmer-herder clashes in Taraba and North-Central states like Benue, Plateau, and Nasarawa have destroyed crops, reduced land access, and displaced communities, significantly influencing food security status (Yisa, et al., 2024). A Taraba study of 400 respondents showed that factors like age, household size, income, land size, and conflict involvement (all $p<0.05$ or $p<0.01$) determine insecurity levels, with 93.5% citing ongoing violence as a barrier to resolution (Yisa, et al. 2024). These conflicts erode agricultural diversity, elevate food prices, and weaken supply chains, creating hotspots where food insecurity intensifies with crisis frequency (Yisa, et al. 2024).

Northwestern banditry in states like Zamfara, Sokoto, and Katsina forces farm abandonment, loots supplies, and disrupts rural markets, compounding national food shortages projected to affect 33.1 million by mid-2025 (Asaju, & Kwakano, 2025) Regression analyses confirm insecurity's negative coefficient (-51.46, $p=0.0038$) on food production from 1960–2024, alongside rural-urban drift, explaining 91% of variance in outputs (Bello, 2024). Inflow of internally displaced persons worsens local consumption scores, with violence deterring investments and inputs like fertilizers (George, et al., 2022)

Affected individuals resort to rationing, migration, and community support, but these yield limited resilience amid eroded social cohesion (Yisa, et al. 2024) Studies recommend enhanced security in farming zones, livestock plans, community task forces, and bottom-up peace-building to restore productivity and access (Yisa, et al. 2024; Bello, 2024).

2.4 Analytical literature

2.4.1 Descriptive Statistics

Descriptive statistics are brief descriptive coefficient that summarizes a given data set which can be either a representation of the entire population or a sample of it. Descriptive statistics are broken down into frequency distribution, measures of central tendency and measures of variability. Frequency distribution is basically a presentation of grouped data categorized based on mutually exclusive classes and the number of occurrence in each respective class. Measures of central tendency include the mean, median and mode; while measures of variability include the standard deviation or variance. Descriptive statistical tools such as mean, percentage and frequency distribution are usually used in the study of socio economic characteristics of the victims of the communal clash, farmer-herder conflicts and climate change.

2.4.2 Net Income model

Net profit figures per enterprise tend to ignore the inter-related nature of enterprises and are thus less useful for organic systems. They are of most use where a farm has one core enterprise (Firth, 1999) and the other enterprises are minor or could be thought to contribute to that core enterprise. One alternative is to apportion only the more easily allocatable costs, such as those related to field operations in crop production, to arrive at a net margin per crop/enterprise. This technique has been adopted in a number of studies investigating the economics of organic farming. This overcomes to some extent, the limitations of gross margins, which fail to take account of fixed costs changes when comparing conventional with organic farming. The difficulties of using net margins are that; firstly there are few if any published ‘standards’ with which to compare. Secondly, costs of field operations are not accurately recorded on all farms, therefore they rely on estimates that may vary from farm to farm, which can cause problems when farm comparison is made. This was overcome in a number of the studies referred to above

by using contractor's charges to arrive at the costs of various operations. Finally, net margins and net profit per enterprise are less appropriate for farm planning, since the fixed costs elements are unlikely to vary directly in proportion to the size of the enterprise. The model is stated as according to Chidiebere-Mark, (2017);

NFI = TR-TVC

Where,

NFI = Net farm income

TR= Total revenue

TVC = Total variable cost

Net farm income is a measure of profitability and is determined based on information derived from a farming operations income statement (Adam, 2011). Net farm income is a crucial metric that reflects the return on the owner's investment in the farm business, considering factors like labor, management, and equity. It serves as a key indicator of the financial health and success of a farming operation, helping the owners assess the worth of their investment in terms of labor and resources (Adam, 2011).

Net farm income = Profitability - Total Variable Cost

or

Net Farm Income = Total Revenue – Total Cost

NFI = TR – TC **(Equ 1)**

Where,

NFI = Net Farm Income

TR = Total Revenue

TC = Total Cost

TC = TVC + TFC **(Equ 2)**

2.4.3. Ordinary Least Squares Regression Model

The OLS is a regression estimate of models to test the relative and global statistics. Ordinary Least Squares regression (OLS) is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or more independent quantitative variables and a dependent variable (simple or multiple linear regression). The model can be extended to include multiple explanatory variables by simply adding additional variables to the equation. The form of the model is the same as above with a single response variable (Y), but this time Y is predicted by multiple explanatory variables (X_1 to X_2). $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$. The interpretation of the parameters (α and β) from the above model is basically the same as for the simple regression model above, but the relationship cannot now be graphed on a single scatter plot. α indicates the value of Y when all vales of the explanatory variables are zero. Each β parameter indicates the average change in Y that is associated with a unit change in X, whilst controlling for the other explanatory variables in the model. Model-fit can be assessed through comparing deviance measures of nested models.

The implicit form of the model is: $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$. **(Equ 3)**

Y = the dependent variable

α = intercepts of the model

$\beta_1, \beta_2, \beta_3$ & β_n = coefficients associated with each explanatory variable

$X_1 \ldots X_n$ = the explanatory variables of the model

The model can be express in four functional forms,

(i) Linear functional form, the functional form is expressed as;

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_n X_n \quad \textbf{(Equ 4)}$$

(ii) Exponential functional form, this functional form is expressed as follows;

$$LnY = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_n X_n. \quad \textbf{(Equ 5)}$$

(iii) Semi-Long functional form, this functional form can be expressed as follows;

$$Y = \alpha + \beta_1 LnX_1 + \beta_2 LnX_2 + \beta_3 LnX_3 + \beta_n Ln X_n \quad \textbf{(Equ 6)}$$

And; (iv) Double-Log functional form, this functional form is expressed as follows;

$$LnY = \alpha + \beta_1 Ln X_1 + \beta_2 Ln X_2 + \beta_3 Ln X_3 + \beta_n Ln X_n \quad \textbf{(Equ 7)}$$

According to Eliot, Rothenberg and Stock (2012), this statistic measures the relationship between or among variables in a model. It tells us the direction of variables between or among dependent and independent variables. The model also shows the magnitude of the independent variables in relation to the dependent variable, i.e. how a unit change in independent variable can affect quantity change in the dependent variable.

It tests the significance of the individual variables, especially the independent variables.

2.4.4. The multinomial logistic regression model for the determinants of coping strategies is specified as follows:

Multinomial logistic regression model is a statistics method for multiclass classification problems. It extends logistics regression to handle more than two possible discrete outcomes. It is used to predict the probabilities of various possible outcomes of a categorically distributed dependent variable, based on independent variables. It is applicable to independent variables that are real-valued, binary-valued, categorical-valued, etc. it is also known as polytomous LR, multiclass LR, softmax regression, multinomial logit, maximum entropy classifier, and conditional maximum entropy model.

The multinomial logistic regression (MLR) formula that was used to analyze factors affecting farmers' choice of coping strategy in managing the conflicts was analyzed by following Apata (2011), Boateng et al,. (2022) and Chikezie (2019), modelling the probability of the multinomial logistic model for this study is as follows:

$$P\left(y=\frac{j}{X}\right)=\frac{\exp\left(x\beta_j\right)}{1+\sum_{k-1}^{j}\exp\left(x\beta_k\right)\ j=1,\ \ \ldots,J} \qquad \textbf{(Equ 8)}$$

Where: $\beta_j = K \ * 1, j = 1 \ldots \ldots J$

Where P = probability of choice of coping management option

Y = Coping management options defined by j = 1, 2 …7

1= Crop diversification (mixed cropping)

2= Tightening farm security

3= Early harvest of crops

4= Seeking assistance from local leaders

5= Praying for peace

6= Building of fences

X_i = (Regressors) X_1, X_2, X_3 X_{14}

j = 0, 1, 2, 3,… 13 are the parameter estimates of the independent variables. In this study, the estimation of the multinomial logistic model was undertaken by normalizing one coping management option, which is normally referred to as the base option. For this analysis, early harvest of cassava was chosen as the base option. The base category is expressed by the following formula:

$$P_{i0} = \frac{1}{1 + exp\beta_j X} \ldots \quad \textbf{(Equ 9)}$$

Where P_{i0} is the probability of being in base category

β_j was estimated

The natural logarithm of the odd ratio gave the estimated equation (Green, 2008) as follows:

$$\frac{P(y)}{P_{i0}} = \beta_j X \quad \textbf{(Equ 10)}$$

This denotes the probability of each group relative to the probability of base category and based on the review of literature on choice of coping management studies.

2.4.4.1 Independence of Irrelevant Alternatives of Multinomial Logit model

It was assumed that economic agents such as households used coping options only when the perceived utility or net benefit from using a particular option was significantly greater than in the base category. Under this framework the utility of the economic agents is not observable, but the actions could be observed through the choices they made. This model provides a convenient closed form for underlying choice probabilities, with no need of multivariate

integration, making it simple to compute choice situations characterized by many alternatives. In addition, the computational burden of the MNL specification is made easier by its likelihood function, which is globally concave (Hausenan and McFadden, 1984),

Conditions imposing an independence from irrelevant alternatives play a central role both in individual choice theory and in social choice theory. Consistency of choice is often associated with some notion that there is an independence of irrelevant alternatives (Gbetibouo, 2009; Tse, 1987). Therefore to ensure Unbiased, efficient and consistent parameter estimates of MNL model, Independence of irrelevant alternatives (IIA) assumption, which states the ratio of probabilities of choosing any two alternatives is independent of the attributes of any other alternative in the choice set must be employed (Hausman and McFadden, 1984). This implies that the tendency of a farmer using a particular coping option needs to be independent of other alternative coping options used by the same farmer (Gbetibouo, 2009; Onyeneke, 2010)

Gbetibouo further explains that the validity of the IIA assumption could be tested using Hausman's specification, which is based on the fact that if a choice set is an irrelevant, eliminating a choice or choice sets from the model altogether will not change parameter systematically (2009).

2.4.4.2 Marginal Effect under Multinomial Logistic Model (MNL)

According to Hausman and McFadden, (1984), the MNL coeefficients are difficult to nterpret but institute of Digital Research and Education (n.d) explain that exponentiating the coefficients give values that measures Relative Risk Ratio. However, to interpret the effects of explanatory variables on the probabilities, marginal effects are usually derived following Greene, (2003, as cited in Nhemachena & Hassan 2007, p. 90). Differentiating equation (12) with respect to the exogenous variables provides marginal effects of the exogenous variables given as:

$$\frac{\partial P_j}{\partial x_k} = P_j\left(\beta_{jk} - \sum_{j=0}^{j-1} P_j \beta_{jk}\right) \ldots \quad \textbf{(Equ 11)}$$

The marginal effects or marginal probabilities are functions of the probability itself and measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable (Greene, 2003).

2.4.5. Measurement of Food Security

Various approaches, such as cost of calorie, coping strategy index, dietary intake assessment, household dietary diversity score, food security index, experience-based food in security scale, household food insecurity assess scale, household economy approach, food consumption score, food poverty approach, household expenditure survey method, and the United States household food security survey module, have been employed to measure the food security/insecurity status. Agidew and Singh (2018) used a binary logit model to determine food insecurity in rural farm households of the Teleyayen sub-watershed area in Ethiopia using a structured survey questionnaire, focus group discussion (FGD) and key informant interviews to collect data from 215 households.

Dietary diversity scores are calculated by summing the number of food groups consumed in the by the individual respondent over the 7-24 hours recall period (Kennedy, Ballard, & Dop, 2011). The following steps are included in creating either the individual dietary diversity score (IDDS):

List 7-12 food group and attach weight to each component depending on class of food each food item belong; Create new food group variables for those food groups that need to be aggregated and finally, compute values for the dietary diversity variable by summing all food groups included in the dietary diversity score. This is done by multiplying the frequency of

consumption of each food item by their corresponding weights and summing together to get the IDDS (FAO, 2008; Kennedy, Ballard, & Dop, 2011).

The Individual Dietary Diversity Score (IDDS). Below is a step-by-step approach for carrying out this assessment:

1. Collect Required Data

A. Body Mass (BMI)

The farmer's weight in kilograms and height in meters was taken and recorded.

Calculation:

BMI = Weight (kg)/Height $(m)^2$

Interpretation:

Underweight: BMI < 18.5

Normal weight: $18.5 \leq$ BMI < 25

Overweight: $25 \leq$ BMI < 30

Obese: BMI ≥ 30

B. Individual Dietary Diversity Score (IDDS)

The farmer was made to recall all the food groups they consumed over the previous 24 hours for one 7 days (1 week).

Common food groups include cereals, tubers, vegetables, fruits, meats, eggs, fish, legumes, milk products, oils, etc.

Each unique food group consumed scores a point. The points was sum with the number for a total score using the formular:

IDDS= W_1CR +W_2PL +W_3Veg + W_4FT + W_5-ME/FS + W_6MK + W_7Cal (IDDS Handbook).

2. Analyze the Data

A. Interpreting BMI in Food Security

Low BMI (underweight) often suggests chronic energy deficiency and possibly severe food insecurity.

High BMI does not automatically indicate food security, as it may reflect diets high in low-cost, energy-dense but micronutrient-poor foods—sometimes observed in "nutrition insecurity" (Kennedy et al., 2011).

Normal BMI is generally associated with better nutritional status but should always be combined with diet data.

B. Interpreting IDDS in Food Security

Low IDDS indicates limited dietary diversity, commonly found in food-insecure populations. Low diversity is consistently associated with poorer micro- and macronutrient intake and higher food insecurity.

High IDDS reflects a diet with a wider range of food groups, generally indicating better food access and improved food security (https://pmc.ncbi.nlm.nih.gov/articles/PMC7482182/).

The individual's food security can be infer as follows:

Food Security Status	Bench mark
Severely Food Insecure	<21
Moderately Food Insecure	21-35
Food Secured	>35

2.4.6. The order probit model for the determinants of food security is specified as follows:

Following Greydanus*et al.,* (2013), ordered probit model was used to analyze factors influencing the food security of cassava farmers experiencing farmer-herder conflict. The reduced form of the unobserved Ordinal Probit model is shown as follows:

$Y^* = Xi\ B + ei,\ ei \sim N(0, 1),\ i=1,\ldots,N \ldots$ **(Equ 12)**

Where Yi is the observed ordinal variable which takes on values 1 through 4. Thresholds partition the real line into a series of regions corresponding to the various ordinal categories.

Where:

(Y) is the dependent variable representing the categories of food security status (e.g., high food security, marginal food security, low food security and very low food security) of cassava farmers.

(j) represents the different categories of food security (with (j = 1) being the reference category).

β_{ij} are the coefficients for the independent variables associated with category j (for i =X_1, X_2, ..., X_k)

$X_1 \ldots X_k$ represents the independent variables (factors influencing food security, such as age, farm size, income, education, etc.).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

This study was carried out in Imo State of Nigeria. Imo State is located in South-Eastern part of Nigeria and shares common boundaries with Abia State on the east and northeast, Rivers State on the south, and Anambra State on the west and northwest. The state is rich in natural resources including crude oil, natural gas, lead, zinc. Economically exploitable floral like the Iroko, Mahogany, Obeche, Bamboo, Lush green grasses (which attracts the herders), rubber tree, and oil pam predominate the state. The State lies within Latitude **5º** and **6ºN**, and Longitude **7º** and **8ºE** of the Greenwich Meridian. According to the ministry of Lands (2019), the total land area of Imo State is **5067.20km^2**. The population of the State is over 4.8 million people with many practicing subsistence farming (NBS, 2006). The total land area Imo State is divided into three (3) agricultural zones which are Owerri zone, Okigwe zone, and Orlu zone. Owerri agricultural zone is made up of (11) Local Government Areas which includes Aboh Mbaise, Ahiazu, Mbaise, Eziniihitte, Ikeduru, Mbaitolu, Ngor Okpala, Owerri Municipal, Owerri North, and Owerri West; Okigwe agricultural zone is made up of (6) Local Government Areas which includes Ehime Mbano, Ihitte Uboma, Isiala Mbano, Obowo, Okigwe, and Onuimo; and Orlu agricultural Zone is comprising of (10) Local Government Areas which includes Ideato North, Ideato South, Isu, Njaba, Nkwerre, Nwangele, Ohaji Egbema, Oguta, Orlu, Orsu, Oru East, and Oru West. Making a total of 27 Local G0vernment Areas in the State. According to Forest Resources Study Nigeria (2018), the climate of Imo State is tropical with a well-defined wet and dry seasons during which mean temperatures ranges between 27^0C-33^0C, respectively and mean rainfall of about 2,000mm. Imo State is situated in a humid zone with humidity ranging from between 51% and 84%. The lowest daily values of relative

humidity are recorded in the early afternoon, while the highest values are recorded in the early morning hours. The state is in the tropical rainforest zone of Nigeria which makes her vegetation conducive for many forest trees and live stocks. They cultivate such crops as cassava, yam, rice, plantain, Maize, melon, and coconut among others while livestock like pig, poultry, and goat are reared. Agribusiness enterprises occupy a prime position in the economic activities of the people (Obasi, & Kanu, 2014). The state is selected for this study because of numerous farming activities and the rate of migration of herders in the State. There is also a significant number of farmers within the state who are negatively affected by the conflict and the majority of them are located in rural areas of Imo State.

3.2 Sample Selection

This study adopted a survey design from the perspective of the cassava farmers as respondents. A multi-stage sampling technique was used. The first stage involved the purposive selection of two agricultural zones in Imo State; Owerri, and Okigwe zones based on the zones with high prevalence of farmer-herder conflict (Okibe, 2022; Ugwoke & Ezeagba, 2018). The study selected purposively selected 10 LGAs from Owerri zone and all the 6 LGAs in Okigwe zone making a total of 16 local government areas to ensure that the zones were well represented in the study. The second stage involved the purposive sampling of 2 communities from each of the 16 LGAs selected making a total of 32 communities due to the high prevalence of farmer-herder conflicts in this areas. The third stage involved the purposive sampling of one (1) village each from each of the 32 communities making a total of 32 villages. The final stage involved a random selection of 3 farmers each from the list of registered cassava farmers with conflict experience gotten from Imo State ADP which served as the sampling frame from which the sampling unit was drawn from, making a total of 96 cassava farmers. From the 96 questionnaire administered to the cassava farmers, only 90 questionnaire was found to be valid. Therefore,

this work made use of the information from the 90 filled questionnaires gotten from the cassava farmers.

3.3 Method of Data Collection

This research work made used of primary data collected through the use of a semi structured questionnaire. Primary data on various socioeconomic and production variables were gotten from the respondents of the study through the administration of semi structured questionnaires to them. The variables that was captured in the questionnaire includes the socio-economic data of farmers, such as age, marital status, household size, years of educational , farming experience, farm cost, farm return, type and frequency of food consumed.

3.4 Method of Data Analysis

The data collected was analyzed using descriptive statistics like the mean, frequency, percentages, anthropogenic measures, individual dietary diversity score, ordinary least squares regression, multinomial logistic model and ordered probit model.

Objectives 1 which is to describe the socioeconomic characteristics of the cassava farmers in Imo State was actualized using descriptive statistics such as mean and percentage

Objective 2 which is to identify the most remote and immediate causes of farmer-herder conflicts among cassava farmers in the area was achieved using the descriptive statistics such as the frequency and percentages.

Objective 3 which is to analyze the effect of conflicts on cassava production on farmer's net income was analyzed using the net farm income model and ordinary least square regression.

Objective 4 which is to examine the most adopted coping strategies to the conflicts and isolate the factors affecting their choices in managing the conflicts was analyzed using the descriptive

statistical tools such as mean, percentages, frequency, etc. and the multinomial logistic regression model.

Objective 5 which is to assess the food security status of cassava farmers in the area, was achieved using anthropogenic measures (height & weight) and individual dietary diversity score

Objective 6 which is to analyze the factors that affect the food security and the effect of farmer-herder conflicts on food security was achieved using the descriptive statistics such as the frequency and percentages and ordered probit model

3.5 Model Specification

Analysis of the effect of conflicts on cassava production on farmer's net farm income following Aromolaran (2025).

The net farm income model is specified as follows:

$$NFI = TR - TC \quad \textbf{(Equ 1)}$$

Where NFI = Net Farm Income

TR = Total Revenue

TC = Total Cost

TC = TFC + TVC

TFC = Total Fixed Cost

TVC = Total Variable Cost

Obayelu et al., (2021) utilized the Ordinary Least Squares (OLS) regression model to estimate the effects of cassava (Manihot esculenta) planting times on economic profitability in Nigeria:

A case study of cassava farmers in Odeda Local Government Area, Ogun State. Following Obayelu et al., (2021), the OLS regression model in this study was employed to analyze the effect of farmers-herders conflicts on the profitability of cassava production, providing insights into the relationship between conflict dynamics and economic outcomes for cassava farmers in the region.

OLS model is expressed as:

The explicit form of the model is: $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$ (**Equ 2)**

Y = the dependent variable

α = intercepts of the model

$\beta_1, \beta_2, \beta_3$ & β_n = coefficients associated with each explanatory variable

$X_{1\ldots} X_n$ = the explanatory variables of the model

Implicit Model $Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, \ldots..U)$ (**Equ 3)**

Where:

Y= Net Farm Income (₦)

X_1= Age (years)

X_2 = Sex (male=1, female=0)

X_3 = Marital Status (married=1, others-0)

X_4 = Farm size (hectares)

X_5 = Farming Experience (years)

X_6 = Farmer's Household Size (numbers)

X_7 = Conflict Factor (Number of occurence)

X_8 = Labour (man days)

X_9 = Size of Farmland Damage by cattle encroachment (hectares)

e= Error term

The *a priori* expectation is stated mathematically as follows:

$X_1, X_2, X_3, X_4, X_5, X_6, X_8 > 0$; $X_7, X_9 < 0$ (Obayelu et al., 2021)

F-value was used to test the overall significance of the OLS.

3.5.1 Identification of the most adopted coping strategies for conflicts and isolate the factors affecting their choices in managing the conflicts

To identify the coping strategies employed by individual farmers in mitigating the effects of conflicts on food security, a 3- stage-type Likert scale was applied. The response options and values assigned was as follows: "Very effective = 3", "Effective = 2", and "Not effective = 1". These values was added and divided by 3 to obtain 2.0 which was regarded as the mean (i.e In order to calculate the mid-value the numbers was summed up and divided by 3 (1+2+3 = 6/3 = 2)). Strategies with a mean score greater than or equal to 2.0 was regarded as "effective" while strategies with mean responses lower than 2.0 was regarded as "not effective".

Factors affecting farmers' choice of coping strategy in managing the conflicts was analyzed using the Multinomial Logistics Model (MLM)

Following Apata (2011), Boateng et al,. (2022) and Chikezie (2019), modelling the probability of the multinomial logistic model for this study is as follows:

$$P\left(y=\frac{j}{X}\right)=\frac{\exp\left(x\beta_j\right)}{1+\sum_{k-1}^{j}\exp\left(x\beta_k\right)\ j=1,\ \ \ldots,J} \qquad \textbf{(Equ 4)}$$

Where: $\beta_j = K \ * 1, j = 1 \ldots \ldots J$

Where P = probability of choice of coping management option

Y = Coping management options defined by j = 1, 2 …7

1= Crop diversification (mixed cropping)

2= Tightening farm security

3= Early harvest of crops

4= Seeking assistance from local leaders

5= Praying for peace

6= Building of fences

X_i = (Regressors) X_1, X_2, X_3 X_{14}

X_1 = Farm size (hectares)

X_2 = Savings (naira)

X_3 =Access to credit (1 = access, 0 = otherwise)

X_4 = Extension visit (numbers)

X_5 = Farming experience (years)

X_6 = Sex (1= male, 0 = female)

X_7 = Non-farm income (naira)

X_8 = Value of assets (naira)

X_9 = Age (years)

X_{10} = Membership of cooperative association (1 for membership, 0 if otherwise)

X_{11} = Farms in different locations (numbers)

X_{12} = Land tenure (1= owned, 0 = otherwise)

X_{13} = Years of education (numbers)

e = error term.

j = 0, 1, 2, 3,… 13 are the parameter estimates of the independent variables. In this study, the estimation of the multinomial logistic model was undertaken by normalizing one coping management option, which is normally referred to as the base option. For this analysis, tightening of farm security was chosen as the base option. The base category is expressed by the following formula:

$$P_{i0} = \frac{1}{1 + exp\beta_j X} \ldots \quad \textbf{(Equ 5)}$$

Where P_{i0} is the probability of being in base category

β_j was estimated

The natural logarithm of the odd ratio gave the estimated equation (Green, 2008) as follows:

$$\frac{P(y)}{P_{i0}} = \beta_j X \quad \textbf{(Equ 6)}$$

This denotes the probability of each group relative to the probability of base category and based on the review of literature on choice of coping management studies, a range of household characteristics and other factors that describe local conditions were hypothesized to influence farmers coping choice in the study area. The *a priori* expectations of the model was as follows:

Farm size, and farms in different locations are associated with greater wealth; it was hypothesized to increase coping to conflict (Boateng et al., 2022). For savings, access to

credit, and land tenure a positive relationship was expected. Also, membership to a cooperative association, farming experience, and extension visit and non-farm income were expected to have positive relationships with coping to conflict (Nhemachena & Hassan, 2007). For this study, sex and non-farm income was theorized to be positively related to coping to conflict.

In this study also, it was hypothesized that age of the farmer negatively influenced coping strategies, though influence of age on a coping choices is mixed in literature. Boateng et al., (2022) found that age is significantly and negatively related to farmers decisions to adopt coping management strategies. On the other hand some found that age is positively related to the coping strategies (Bayard, Jolly & Shannon, 2007).

The *a priori* expectation is stated mathematically as follows:

X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_{10}, X_{12}, and X_{13},> 0; X_9, X_{11} < 0 (Boateng et al., 2022)

Chi Square from the Likelihood Ratio Statistics was used to test the overall significance of the multinomial model (Deressa *et al*., 2008).

3.5.2. Assessment of the food security status of the cassava farmers and their determining factors

To assess the food security status among the individual cassava farmers, we estimated anthropometric measures and individual dietary diversity score (IDDS) (Kennedy, Ballard, & Dop, 2011).

The information required for calculating Body Mass Index are the respondents height and weight. The formula for body mass index is as follows:

BMI = WT (kg)/ HT (m^2)

Where: BMI = Body mass index

WT = Weight

HT = Height

The rule for asserting the food security of farmers using BMI is given below:

Interpretation:

Underweight: BMI < 18.5

Normal weight: 18.5 ≤ BMI < 25

Overweight: 25 ≤ BMI < 30

Obese: BMI ≥ 30

For the individual dietary score, a recall of 24 hours for 7 days was adopted to estimate IDDS, Following Arimond et al., (2010). A straightforward count of the foods consumed from the 16 food groups—cereals, vitamin A-rich vegetables and tubers, white roots and tubers, dark-green leafy vegetables, other vegetables, vitamin A-rich fruits, other fruits, organ meat, flesh meat, eggs, fish, legumes, nuts, and seeds, dairy, oils and fats, sweets, and condiments were uused to calculate the individual dietary scores as follows:

$IDDS = W_1CR + W_2PL + W_3Veg + W_4FT + W_5\text{-}ME/FS + W_6MK + W_7Cal$

Where:

CR= Cereals

PL= White tubers/Roots

Veg = Vegetables

FT= Fruits

ME/FS= Meat/Fish

MK= Milk/ Milk product

Cal= Oils, Fats, Sweets and Condiments

$W_1, W_2, W_3, \ldots W_7$ = weight of each class of food

Farmers were asked to recall all foods consumed by the individual during the last 24 hours for 7 days. A 24-hour dietary recall was used as a proxy for the micronutrient adequacy (utilization and accessibility) dimensions of food security. In order to overcome the error associated with a recall regime, the 24-hours recall was applied on different occasions to the same individual to estimate their usual food intakes for 7 days. For each of the designated food groups, we assign a score of one if the individual consumed at least one item from that group during the 24-hour recall period and zero if the individual did not consume any of the item from that food group during the 24-hour recall period for 7 days. Weights were then assigned to each of the food groups depending on the food class (Arimond et al., 2010).

The scores were then generated using equation 7

The scores were classified using the following benchmark as shown below:

Food Security Status	Bench mark
Severely Food Insecure	<21
Moderately Food Insecure	21-35
Food Secured	>35

Following Greydanus*et al.,* (2013), ordered probit model was used to analyze factors influencing the food security of cassava farmers experiencing farmer-herder conflict. The reduced form of the unobserved Ordinal Probit model is shown as follows:

$Y^* = Xi\ B + ei,\ ei \sim N(0, 1),\ i=1,\ldots,N$ ….. **(Equ 7)**

Where Yi is the observed ordinal variable which takes on values 1 through 3. Thresholds partition the real line into a series of regions corresponding to the various ordinal categories.

Where:

(Y) is the dependent variable representing the categories of food security status (e.g., food secure, moderately food secure, and severely food secure) of cassava farmers.

(j) represents the different categories of food security.

β_{ij} are the coefficients for the independent variables associated with category j (for i =X_1, X_2, ..., X_k)

$X_1 \ldots X_k$ represents the independent variables (factors influencing food security, such as age, farm size, income, education, etc.).

X_1 = Sex (dummy variable: male=1; female=0)

X_2 = Years of education (Numbers)

X_3 = Household size (number of persons living in a household)

X_4 = Age (in years)

X_5 = Farming experience (Numbers)

X_6 = Membership of cooperative society (dummy variable: member=1; otherwise=0)

X_7 = Extension visit (number of visits)

X_8 = Access to credit (Dummy variable, yes=1; No=0)

X_9 = Farmers Income (farm and non-farm income in ₦)

X_{10}=Land ownership (Dummy variable, yes=1, No=0)

X_{11}=Conflict factor (frequency -Dummy variable, yes=1, No=0)

X_{12}= Farm Size (Hectares)

e = Error Term

The *a priori* expectation is stated mathematically as follows:

X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10} and $X_{12} > 0$; $X_{11} < 0$ (Greydanus *et al.*, 2013; Ofuoku & Osife, 2009)

Chi Square from the Likelihood Ratio Statistics was used to test the overall significance of the ordered probit model (Greydanus *et al.*, 2013)

3.6 Test for Hypotheses

Section 3.5 shows the three different hypotheses tested and the decision rules adopted

Hypothesis one which states that Age, Sex, Marital Status, Farm size, Farming Experience, Farmer's Household Size, Conflict Factor, Labour, Size of Farmland Damage by cattle encroachment do not significantly affect cassava farmers net farm income in the study area was tested using the F-values produced by fitting the ordinary least square models to the relationship between net farm income and some determining factors, and compared them with tabulated values at n-k degrees of freedom and specified alpha level for relevant estimates of bi.

Hypothesis two states that Farm size, Savings, Access to credit, Access to extension services, Farming experience, Sex, Net income, Primary occupation, Age, Membership of cooperative association, Land fragmentation, Land tenure, Government policies and Educational level do not significantly influenced cassava farmers choice of conflict coping strategies in the study area was tested using likelihood ratio statistics. This is consistent with Cong and Yao (2021). The likelihood ratio statistics was used to test that the entire slope coefficient are simultaneously not equal to zero (Gujarati & Porter, 2009). Chi Square from the Likelihood Ratio Statistics tests the overall significance of the multinomial model

Hypothesis three states that Sex, Years of educational attainment, Household size, Age, Farming experience, Membership of cooperative society, Number of extension contacts per month, Access to credit, Farusing likelihood ownership, Frequency of farmer-herder conflict and Farm Size do not significantly influence the food security of cassava farmers in the study area was tested using likelihood ratio statistics.

CHAPTER FOUR

4.0 Results and Discussion

This chapter presents the results and discussions on the result obtained from the data collected for this study. The results on the socio-economic characteristics of the cassava farmers, the results on the most remote and immediate causes of the conflict, the results on the effect of conflict on the cassava production net farm income of the cassava farmers, the result on the most adopted coping strategies to the conflicts and isolate the factors affecting their choices in managing the conflicts in the study area, the result on the food security status of cassava farmers in the area and the result on the factors that affect food security and the effect of farmer-herder conflicts on food security in the study area. Therefore, it is organized into sub-headings based on the specific objectives of the study.

4.1 Socio-Economic Characteristics of Cassava Farmers in Imo State

The farmers' socio-economic characteristics such as sex, marital status, Household size, years of education, major occupation, membership of cooperative association, age, and years of experience were analyzed and discussed.

4.1.1 Sex Distribution of the Cassava Farmers

The sex distribution of the cassava farmers in Imo State is presented in Table 4.1 below: The result shows the percentage distribution of male and female cassava farmers in the State.

Table 4.1. Sex Distribution of Cassava Farmers in Imo State

Sex	Frequency	Percentage
Male	37	41.1
Female	53	58.9
Total	90	100.0

Source: Computed from Field Survey Data 2025

The result shows that larger proportion of the respondents were female (58.9%) while the males were (41.1%).This shows that women dominated the cassava production in the area, supporting the fact that cassava farming is primarily women activity in the rural areas. This findings agrees with the study of Uneze and Ihunwo (2021), who reported that majority (62.5%) of the cassava farmers were females, this lends credence to the assertion that African farmer is a woman. Increase in the number of female cassava farmers increases the quality of cassava. Also, Nwankwo (2023) found that women dominated crop farming by 61.67%, and Abushe et al., (2023) postulates that majority (69.75%) of the cassava farmers were female.

4.1.2. Distribution of the Respondents based on Marital Status

The marital status distribution of the cassava farmers in Imo State is shown in Table 4.2 below. The marital status of these cassava farmers shows that they are either single or married but among the married ones have few who have divorced their partners.

Table 4.2. Distribution of the Respondents based on Marital Status

Marital Status	Frequency	Percentage
Single	5	5.6
Married	83	92.2
Divorced	2	2.2
Total	90	100.0

Source: Computed from Field Survey Data 2025

The result shows that (5.6%) of the respondents were singles, (92.2%) were married, and (2.2%) were divorced. This implies that majority of the respondents in the study area were married. This shows the role of married people play in developing the cassava sector in the rural area, supporting their households through cassava production. The result aligns with the findings of Oyem et al., (2024) who reported that being married would mean that the respondents were responsible and had a sense of reasoning to think of their future on how to improve their farming activities, as well as how to overcome challenges of their enterprise.

4.1.3 Distribution of respondents Based on House-Hold Size

The distribution of cassava farmers based on the household size is presented in Table 4.1.3.

Table 4.3 Distribution of respondents Based on House-Hold Size

Range of HH Sizes	Frequency	Percentage
1-5	47	52.2
6-10	41	45.6
11-15	2	2.2
Total	90	100.0
Mean	5.79	

Source: Computed from Field Survey Data 2025

From the result above, the household size of these farmers averages around 6 members, ranging from a minimum of 1 to a maximum of 14. Also, it can be deduced that the cassava farmers have high number of household size with the highest number (1-5) of house size of (52.2%) and the lowest number (11-15) of household size of (2.2%). The percentages with the highest number of household size indicates that there is an availability of family labour which will help to reduce the cost of labour in the cassava farming which supports the work by (Zamanti and Jaderka, 2016) that the average household size of 5-8 people obtained is an indication of large family size which implies availability of family labour to the farmers. Owigho et al., (2023) affirm that household will help in farm activities. This will also give the farmers chance to cultivate more land and spend less for hired labour during conflict.

4.1.4 Distribution of Respondents according to years of Education

Table 4.4 Distribution of Respondents according to years of Education

Education (years)	Frequency	Percentage
1-6	9	10
7-12	43	47.8
13-18	38	42.2
Total	90	100.0
Mean	13.63	

Source: Computed from Field Survey Data 2025

The result shows that on average, the farmers have about 13.63 years of formal education, indicating a relatively educated farming community. It could also be ascertain that majority (47.8%) of the farmers had a maximum of secondary education. The high percentage of farmers with high proportional level of education can be deduced that the farmers are knowledgeable and can cope with the level of conflict in the area. According to Ojoko et al (2017) having high level of educated farmers can bridge the gaps require to play pivotal role in adaptation and mitigating conflict while simultaneously increasing agricultural productivity and incomes.

4.1.5 Distributions of Respondents according to Major Occupation

Table 4.5 major occupation

Major Occupation	Frequency	Percentage
Yes	89	98.9
No	1	1.1
Total	90	100.0

Source: Computed from Field Survey Data 2025

The result shows that high percentage of the cassava farmers take it as their major occupation. A majority of (95.6%) of the farmers in the study area engage in cassava farming as their major occupation while (1.1%) accounts for those who engage in it as their minor occupation. This means that while agriculture is an occupation there is other things that take most of their time

in the area, this supports the work by (World Bank, 2014) that agriculture employs 60% of Nigerians; including many rural women at both major and minor level of engagements levels but 84% of rural households in Nigeria engage majorly in the same occupation.

4.1.6. Distribution of Respondents Based on Member of Cooperative

Table 4.6 Member of Cooperative organization

Mem. of Coop.	Frequency	Percentage
Not members	59	65.6
Members	31	34.4
Total	90	100.0

Source: Computed from Field Survey Data 2025

The result above shows that (34.4%) of the respondents were members of a cooperative society while majority (65.6%) were not members cooperative society, this suggests that they did not understand the importance and role of being a member of cooperative society in enhancing their farming enterprise in terms of access to some productive resources like access to credit, subsidize inputs, training on handling farmers-herders conflict and many more. Oyem et al., (2024) affirm that farmers who are members of cooperative have a higher net income than cassava farmers who are not.

4.1.7. Distribution of Respondents Based on Age

Table 4.7 Based on Age

Age Range	Frequency	Percentage
10-25	1	1.1
26-41	12	13.3
42-57	49	54.4
58-72	28	31.2
Total	90	100.0
Mean	52.23	

Source: Field Survey 2025

The result above shows that the average age of the cassava farmers in Imo State is approximately 52 years, with the youngest being 18 and the oldest being 68. The result shows that (54.4%) were within the age range of 42-57 years while (31.2%) of them are older than 57 years. About (13.3%) accounts for those within the age range of 26- 41years but only (1.1%) accounts for farmers who are younger than 25 years which suggest that the farmers are still in their active productive years and can better cope with the farmer-herder conflict. Consequently, they may respond violently or aggressively to herders due to youthful exuberance (Rukwe, et al., 2019).

4.1.8. Distribution of Respondents Based on Years of Farm Experience

Table 4.8 Based on years of farming experience

Years of Exp	Frequency	Percentage
1-15	19	21.1
16-30	53	58.9
31-45	18	20.0
Total	90	100.0
Mean	24.27	

Source: Computed from Field Survey Data 2025

The farmers possess an average of 24.4 years of farming experience. With the highest range of 16-30 years of farming experience at 58.9% while the lowest range of 1-15 years of farming experience is at 21.1%. The farmers' years of farming experience will improve their coping and adaptability during the period of conflict. The result supports the work by Zamanti and Jaderka (2016), which postulates that as one gets proficient in the methods of production, optimal allocation of resources is expected to be achieved.

Table 4.9: Summary of the Socio-Economic Characteristics of the Cassava Farmers Sampled

	Sex	Marital Status	HH. Size	Years of Edu	Maj. Occp	Mem. Coop	Age	Years of Frm Exp
N	90	90	90	90	90	90	90	90
	0	0	0	0	0	0	0	0
Mean	0	1	5.79	13.63	.98	.34	52.23	24.27
Median	0.56	1.00	5.00	12.00	1.00	.00	45	27
Mode	0	1	5	12	1	0	52	30
Minimum	0	0	3	0	0	0	18	5
Maximum	0	1	14	18	2	1	68	45

Source: Computed from Field Survey Data 2025

Table 4.1.9 above shows the socio-economic characteristics of cassava farmers in the study area. It shows that, the mean of the sex of the cassava farmers was (1), the mean of the marital status of the cassava farmers was (0.97), the mean of the household size the cassava farmers was (5.79), the mean of the years of education of the cassava farmers was (13.63). Also, the table above explained that, the mean of the major occupation of the cassava farmers was (0.98), the mean of cassava farmers' membership to any cooperative association was (0.34), the mean age of the cassava farmers was (52.23) and the mean of their farming experience was (24.27).

4.2. Identifying the Most Remote and Immediate Causes of Farmer-Herder Conflicts among Cassava Farmers in the Study Area

4.2.1 Remote and Immediate causes of Farmer-Herder Conflict

The causes of conflicts between farmers and herders must be well established before any meaningful strategies for prevention/management may be proffered. In this study attempt was made to categorize the causes of the conflict into two remote causes and immediate causes.

The remote causes are hidden causes which may not be apparent in farmer-herder relationship but yet a portent force that fuels the conflict. They include: communal land resource,

community water resource, low rainfall, decline in grassland, ineffective government policy implementation, over grazing of farmland, and destruction of farm by cattle herders.

The immediate causes are the ones that can trigger off conflict here and now. They include: killing of cattle by farmers, theft off cattle by indigents, sexual harassment of women by herders, and indiscriminate bush burning.

Table 4.10 Index Result for Remote Causes of Farmer-Herder Conflict

S/No	Perceived Remote Causes	Very Serious (Freq. & %)	Serious (Freq. & %)	Not Serious (Freq. & %)	Mean Score	Rank
1.	Destruction of farm by cattle herders	85 (94.4)	3 (3.3)	2 (2.2)	2.922	1st
2.	Ineffective Government policy implementation	67 (74.4)	17 (18.9)	6 (6.7)	2.678	2nd
3.	Decline in grassland	55 (61.1)	26 (28.9)	9 (10.0)	2.511	3rd
4.	Communal land resource	43 (47.8)	37(41.1)	10(11.1)	2.367	4th
5.	Community water resource	Decline in grassland	47 (52.2)	21 (23.3)	2.011	5th
6.	Over grazing of farmland	54 (60.0)	32 (35.6)	4 (4.4)	1.889	6th
7.	Low rainfall	13 (14.4)	45 (50.0)	32 (35.6)	1.789	7th

Source: Computed from Field Survey Data 2025

The result of the remote causes of farmer-herder conflict in the study area is presented in Table 4.10. the result shows that the destruction of farm by cattle herders with a mean score (2.922), ineffective government policy implementation with a mean score (2.678), decline in grassland with a mean score (2.511), communal land resource (2.367), and community water resource (2.011) were indicated as the very serious remote cause for farmer-herder conflict with their respective mid-value greater than the mid-value (2). Furthermore, it can be deduced that destruction of farmland by cattle herder, ineffective government policy implementation, declined in grassland, communal land resource, and community water resource were the main remote causes of the conflict and were ranked in this order of the highest remote causes of 1st,

2nd, 3rd, 4th, and 5th respectively. Also, it can be seen from the result that the mean score for over grazing of farmland (1.889), and low rainfall(1.789) were below the mid-value showing that overgrazing of farmland and low rainfall were not a serious remote causes of farmer-herder conflict. These two ranked 6th and 7th respectively and their weighted mean scores were (1,889 and 1.789) and are below mid value 2.

Table 4.11 Index Result for Immediate Causes of Farmer-Herder Conflict

S/No	Perceived Immediate Causes	Very Serious (Freq. & %)	Serious (Freq. & %)	Not Serious (Freq. & %)	Mean Score (mid-value 2)	Rank
1.	Sexual Harassment of Female Farmers by the Herders	57 (63.3)	25 (27.8)	8 (8.9)	2.544	1st
2.	Indescriminate Bush Burning	45 (50.0)	43 (47.8)	2 (2.2)	2.478	2nd
3.	Killing of Cattle by Farmers	26 (28.9)	12 (13.3)	52 (57.8)	1.711	3rd
4.	Theft of Cattle by Indigents	13 (14.4)	21 (23.3)	56 (62.2)	1.522	4th

Source: Computed from Field Survey Data 2025

The result in table 4.11, shows that sexual harassment of female farmers by the herders (2.544), and indiscriminate bush burning (2.478) were all identified to be the most immediate causes of this conflict between the farmers and herders and are ranked 1st, and 2nd respectively. Considering the mid-value of the index which is 2, it can be deduced that sexual harassment of female farmers and indiscriminate of bush burning are the immediate causes of the farmer-herder conflict because of the weighted mean score of (2.544) and (2.478) and are higher than the mid value. Furthermore, killing of cattle by farmers (1.711) and theft of cattle by indigens (1.522) are found to be below the mid value of 2, indicating that they are not really the immediate causes of the conflict.

This result is in tandem with the findings of Abushe et al., (2023) that majority of the respondents (80.25%) reported that the most causes of farmer-herder conflicts is destruction of crops and farmland, raping of women, killing of farmers and dispute over land which could be as a result of competition for scarce resources. Also, Enimu (2019) and Ejim et al., (2023) reported that destruction of crops and farmland among other scarce resources were earlier causes of farmer-herder conflict. This reveals that the immediate causes of the conflict were destruction of farmlands, contamination of streams by the herders and killing of cattle, while the remote causes are include competition of farmland and water resources, and government ineffective environmental policy.

4.3. Results of the Net Farm Income and Ordinary Least Square Regression Analysis

4.3.1 Net Farm Income of the Cassava Farmers in the Study Area

The results of the net farm income of the cassava farmers in the study area is presented in Table 4.3.1.

Table 4.12: Net Farm Income of Cassava Farmers' per Harvest

Items	Mean Quantity	Mean Unit Price (₦)	Mean Total Amount (₦)
Sales			
Cassava tubers	13.26 kg	15,000	198,900.00
Cassava stem	29.04 bundles	2,500	72,600.00
(A) Total Revenue (TR)			₦271,500.00
Variable Cost			
Cassava stems	15 bundles	2500	37.500
Fertilizer	2 bags of 50kg	14,000	28,000
Agrochemical	2 bottles of 1lite	6,500	13,000
Labour	4 persons @ 5,000 man-day		20,000
(B) Total Variable Cost (TVC)			₦98,500
(C) Depreciated Fixed Input (FC) (i.e Hoe, Shovel, Cutlass, Wheelbarrow)			55,882.22
(D) Total Cost (TC) (B+C)			₦154,382.22
Net Farm Income (NFI) (A – D)			₦117,117.78
ROI (NFI/TC)*100			75.86%

Source: Computed from Field Survey Data, 2025

The results of Table 4.12 show that cassava production in the study area remains a profitable enterprise, with an average net farm income (NFI) of ₦117,117.78 and a return on investment (ROI) of 75.86%. This indicates that for every ₦1 invested in cassava farming, farmers earned approximately ₦0.76 in profit. The findings suggest that, under normal production conditions, cassava farming contributes significantly to individual income and rural livelihoods.

However, the persistence of farmer–herder conflicts in several parts of State poses a major threat to the sustainability of such profitability. Studies have shown that violent clashes often lead to the destruction of farmland, displacement of farming households, and restricted access to cultivable land (Okoli & Atelhe, 2014). In cassava-producing areas, the encroachment of

cattle on cultivated fields frequently results in crop destruction, thereby eroding farmers' expected revenues and discouraging continued investment in production.

For instance, Akinde & Adekunle (2024), reported that farmer–herder conflicts in Ogun State, Southwest Nigeria reduced cassava farmers' effective farm size by up to 25%, leading to lower output and income. Similarly, Ojo *et al* (2019) noted that households in conflict-prone zones often divert resources toward security or abandon farming altogether, reducing their overall profitability despite the crop's inherent economic potential. This implies that while the present study recorded an ROI of 75.86%, profitability could be even higher in the absence of conflicts that constrain productivity and market participation.

Moreover, the high variable costs observed in this study (₦98,500.00), particularly for labour (₦20,000.00) and fertilizer (₦28,000.00) may also be partly influenced by insecurity. In areas affected by conflict, labour supply becomes scarce due to rural-urban migration, thereby inflating the cost of hiring farm workers. Additionally, insecurity disrupts the distribution of agricultural inputs, further raising production costs and undermining farmers' ability to maximize returns.

Therefore, while cassava farming remains profitable in the study area, the threat of farmer–herder conflicts significantly moderates this profitability.

4.3.2 Factors Affecting the Net Income of Cassava Farmers

The result of the factors affecting cassava farmers' net income is presented in Table 4.13

The regression estimate of the factors influencing the net farm income of the cassava farmers in Table 4.13. The double log functional form was chosen as the lead equation based on statistical and econometric reasons, such as high magnitude of the coefficient of determination, the number of significant variables, and the agreement of the signs borne by the coefficient of the variable with a priori expectation, as well as the significance of the F ratio

Table 4.13: Factors affecting the net income of the cassava farmers in the study area

Explanatory Variables	Exponential	Linear	Semi-log	Double Log+
Constant	11.818 (36.098)	-66152.688 (-0.484)	-244386.052 (-0.744)	11.408 (16.458)
SEX	-0.091 (-0.832)	-955.868 (-0.021)	82314.311 (1.011)	0.012 (0.069)
MS	-0.166 (-1.200)	-62046.036 (-1.075)	-137018.541 (-1.641)	-0.353 (-2.004)**
AGE	-0.005 (-1.093)	-3340.623 (-1.700)	-88466.694 (-1.011)	-0.163 (-0.882)
EDULEVEL	0.028 (2.798)***	14686.473 (3.463)***	242307.618 (3.492)***	0.449 (3.066)***
FEXP	0.01 (1.618)	284.112 (0.112)	22112.94 (0.487)	0.187 (1.948)**
FAMSIZE	0.344 (10.287)***	175779.092 (12.581)***	346432.113 (6.376)***	0.699 (6.092)***
HHSIZE	0.022 (1.068)	8191.1 (0.952)	146491.265 (2.008)**	0.317 (2.059)**
CONFLICT FACTOR	0.022 (0.394)	14601.214 (0.62)	-18205.349 (-0.283)	0.026 (0.194)
LNDAMAGE	0.042 (0.333)	3289.624 (0.062)	28684.812 (1.032)	0.062 (1.057)
R^2	0.681	0.738	0.604	0.634
Adj R^2	0.645	0.709	0.548	0.582
F-Statistics	19.195	25.354	10.846	12.315***

Source: Field Survey Data, 2025, Note: *, ** = 1%, 5% probability level respectively**

The study examined the effect of the farmer-herder conflict on the cassava production on the net farm income of individual cassava farmers using various functional forms of regression models, including exponential, linear, semi-log, and double log forms. The choice of functional form is crucial for capturing the true relationship between net farm income and explanatory variables, as well as for improving model efficiency and interpretability (Gujarati & Porter, 2009).

Out of the four functional forms examined, the double log was chosen as the lead equation based on the highest explanatory power, explaining about 63.4% of the variations in net farm income. The lead equation also shows the greatest number of significant variables at the 5% and 1% level, making it the lead equation and the best fit for interpreting the effect of various factors on farmers' earnings. The coefficient of multiple determination (R^2) was 0.634 which implies that 63.4% of variation in the net farm income was explained by the variable included in the model. The double log model was chosen as the lead equation for discussing the factors affecting net farm income among cassava farmers due to its interpretative advantage and robustness in modeling elasticity of variables (Gujarati & Porter, 2022). Unlike linear and semi-log models, the double log form allows direct interpretation of coefficients in percentage terms, facilitating an understanding of the relative impact of explanatory variables on net farm income (Wooldridge, 2021). The adjusted R^2 of 0.582 and an F-statistic of 12.315 at 1 % level of significance which indicates a reasonably good fit and overall model significance.

Educational level (EDULEVEL) positively and significantly influences net farm income at the 1% level (B = 0.449, t = 3.066), which implies that increase in educational level increases the net farm income. This result aligns with the findings of Badu-Apraku et al. (2023), who argued that higher education improves farmers' adoption of innovative techniques, access to market information, and efficient resource management, thereby boosting farm income. This means that farmers with higher education levels tend to earn more from cassava farming, likely

because education improves their ability to adopt new farming techniques, manage resources better, and make informed decisions that boost productivity and profits, supporting findings by Nwaru (2004) that education enhances farmers' efficiency and income and also as supported by Umar et al. (2021). Similarly, farm size (FAMSIZE) exhibits a highly significant positive effect at 1% (B = 0.699, t = 6.092), which implies that the larger the farm size the more output from the farm, thereby contributing to productivity and net farm income. Farm size has the strongest positive influence on income. Larger farms provide farmers more land to cultivate, enabling greater production of cassava tubers and stems, which naturally leads to higher total earnings. This confirms a widely recognized principle in agriculture: larger landholdings often help farmers achieve economies of scale and increase overall return. These observations are consistent with recent research by Chanda, Shawa, and Kuntashula (2024), who emphasized the critical role of farm size and education in shaping the income outcomes of smallholder cassava farmers. Household size (HHSIZE) also shows a positive and statistically significant association (B = 0.317, t = 2.059), implying that the larger the number of households that engage in farming activity, the more the net farm income achieve. Farmers' experience (FEXP) is significant at the 5% level (B = 0.187, t = 1.948) positively affects income, indicating that accumulated knowledge and skills attained over time improve farm management and profitability (Nweke et al., 2022). Conversely, marital status (MS) has a significant and negative coefficient (B = -0.353, t = -2.004), potentially reflecting increased household responsibilities or resource constraints that affects farm performance (Smith & Johnson, 2023). Other variables such as sex (SEX), age (AGE), conflict factor, and land damage were not statistically significant in the model, suggesting limited direct influence on net farm income in this particular setting. Implications of these significant results highlight the critical role of education, labor availability, and experience in enhancing cassava farmers' net income, implying that policies aiming to improve educational access, promote family labor

mobilization, and farmer training could be effective strategies for increasing farm profitability during conflict in the study area.

From a practical perspective, these findings imply that improving farmer education through training, increasing access to land or encouraging cooperative farming arrangements to expand farm size, and optimizing household labor use could be effective strategies to boost cassava farmer incomes. The lack of significant in sex or marital status effects also indicates that cassava farming success might be accessible across different demographic groups, though understanding social factors more deeply could be beneficial.

The OLS regression analysis showed that among the socioeconomic and conflict-related variables examined, farm size was the only statistically significant factor influencing net farm income at 1% significance level. Larger farm sizes were positively associated with higher farm income, implying that despite conflict disruptions, scale advantages allowed some farmers to cushion losses.

The variable representing conflicts factor was included as a predictor in all regression models. Across all models, conflict's coefficients (both unstandardized and standardized) appear relatively small and statistically insignificant in explaining variations in both cassava production and net income. These findings suggest that conflict, as measured in this study, does not have a statistically significant direct effects on cassava production or farmer's net income in the study area when controlling for other variables.

The lack of a significant direct effect of conflict on cassava production and income aligns with some studies that find agricultural resilience in certain conflict-prone settings, where farmers adapt to shocks or conflicts are localized and do not severely disrupt farming activities (Azam, 2011; Justino, 2015). However, this contrasts with broader literature indicating that conflicts often reduce agricultural productivity through destruction of assets, labor displacement, and market disruption (Brück et al., 2012; Upton et al., 2020).

4.3.3 Test of null hypothesis I: states that Age, Sex, Marital Status, Farm size, Farming Experience, Farmer's Household Size, Conflict Factor, Labour, Size of Farmland Damage by cattle encroachment do not significantly affect cassava farmers net farm income in the study area was tested using the F-values produced by fitting the ordinary least square models to the relationship between net farm income and some determining factors, and compared them with tabulated values at n-k degrees of freedom and specified alpha level for relevant estimates of bi.

From the provided Table 4.3.2 results: The hypothesis was tested using F-values from ordinary least squares models fitted to the relationship between net farm income and these factors.

Significant variables (at 1% or 5%) in the double log model (preferred, given significance and model statistics) include Marital Status (MS), Education Level (EDULEVEL), Farming Experience (FEXP), Family Size (FAMSIZE), Household Size (HHSIZE).

Age, Sex, Conflict Factor, and Land Damage were not significant in the models as their t-ratios were low and not significant.

The overall F-statistic for the best model (Double Log) is significant at 1%, indicating the model fit is good and explanatory variables collectively explain variation in net income.

Marital status, education level, farming experience, family size, and household size significantly affect cassava farmers' net income.

Age, sex, conflict factor, and farmland damage by cattle are not significant factors.

Labor is not explicitly listed but farm size (likely related to labor input) is notably significant in other studies.

Ogunleye et al. (2025) found farm size, farming experience, and household size positively and significantly correlated with net farm profit among cassava farmers, while age and sex showed no significant effect. Education was often positively associated with profitability

(Ogunleye et al., 2025). Akpan et al. (2013) identified land area and labor as critical for profit generation but noted that age negatively impacted output. Afolami and Ogungbenro (2018) found education, credit access, farming experience, household size, and marital status as significant profit efficiency factors.

These studies confirm that age and sex often are not significant predictors of net income but farm size, education, and farming experience are important determinants.

Thus, the hypothesis is partially rejected. Certain factors like marital status, education level, farm size, farming experience, and household size significantly affect cassava farmers' net income, while age, sex, conflict factor, and farmland damage do not significantly impact net income in the study area.

4.4.1 Perceived Most Adopted Coping Strategies

Table 4.14 Index Results For Perceive Coping Strategies Employed in Managing Farmer-Herder Conflict

S/No	Perceived Coping Strategies	Very Effective	Effective	Not Effective	Mean Score	Rank
1.	**Crop Diversification (mixed cropping)**	68 (75.6)	11 (12.2)	11 (12.2)	2.633	**1st**
2.	**Building of Fences**	57 (63.3)	8 (8.9)	25 (27.8)	2.356	**2nd**
3.	**Praying for Peace**	26 (28.9)	17 (18.9)	47 (52.2)	1.767	**3rd**
4.	**Tightening Farm Security**	14 (15.6)	36 (40.0)	40 (44.4)	1.711	**4th**
5.	**Early Harvest of Crops**	22 (24.4)	20 (22.2)	48 (53.3)	1.711	**5th**
6.	**Seeking Assistance from Local Leaders**	0 (0)	25 (27.8)	65 (72.2)	1.278	**6th**

Source: Computed from Field Survey Data 2025

The result shows that the responses of the sampled cassava farmers were measured using a 3-type Likert scale with a mid-value of 2. The table shows that the coping strategies, such as crop diversification (mean = 2.633) and building fences (mean = 2.356), were very effective coping strategies, ranking 1st and 2nd, respectively, with mean scores exceeding the mid-value of 2. The findings also show that praying for peace (mean=1.767), tightening of farm security (mean=1.711), early harvest of crops (mean=1.711), and seeking assistance from local leaders (mean=1.278), were not effective coping strategies and were ranked 3rd, 4th. 5th. and 6th respectively. Because the mid-value for the index was found to be 2, it shows that all these coping strategies are Not Effective enough to be employed to manage the farmer-herder conflict among the cassava farmers as their respective mean scores was not up to the mid-value 2.

Table 4.15 Isolating Factors Affecting the Choice of Coping Strategies

S/no	Factors	Crop Diversification	Early Harvesting	Seeking Assistance	Praying for peace	Building of fences
X_1	Farm Size	-0.474	1.044	-0.390	1.190	0.197
		(0.652)	(0.199)	(0.456)	(0.763)	(0.728)
X_2	Savings	0.914	-0.988	-0.625	-0.326	-0.629
		(0.494)	(0.307)	(0.281)	(0.593)	(0.329)
X_3	Access to	23.335***	16.800	19.598***	-0.443	0.083
	credit	(0.000)	(0.998)	(0.000)	(0.782)	(0.951)
X_4	Ext. visit	0.134	-0.058	0.055	0.008	0.058
		(0.152)	(0.326)	(0.178)	(0.844)	(0.150)
X_5	Farm. Exp.	0.247**	-0.080	-0.008	0.061	0.044
		(0.038)	(0.166)	(0.817)	(0.115)	(0.254)
X_6	Sex	-3.026	0.912	-0.117	0.343	-0.141
		(0.150)	(0.204)	(0.849)	(0.579)	(0.816)
X_7	Non-farm	0.756	-1.646**	-0.709	0.323	-0.309
	income	(0.582)	(0.074)	(0.249)	(0.579)	(0.601)
X_8	Value of	0.000**	0.000	0.000	0.000	0.000**
	assets	(0.023)	(0.163)	(0.332)	(0.509)	(0.024)
X_9	Age	0.007	0.011	0.008	-0.080**	-0.039
		(0.929)	(0.855)	(0.848)	(0.069)	(0.332)
X_{10}	Mem. Of.	1.660	0.270	0.234	0.447	-1.026
	Coop.	(0.182)	(0.737)	(0.699)	(0.509)	(0.121)
X_{11}	Farms in	-1.973	-18.516***	-0.354	1.240	0.878
	different.	(0.238)	(0.000)	(0.662)	(0.117)	(0.301)
	location					
X_{12}	Land tenure	-2.738	-0.219	0.964	-0.369	-0.240
		(0.126)	(0.792)	(0.163)	(0.578)	(0.711)
X_{13}	Years of	0.290**	0.115	0.023	0.087	0.034
	Education	(0.089)	(0.176)	(0.743)	(0.208)	(0.608)

Source: Field Survey Data 2025 Note: *, ** = 1%, 5% of prob. level, (…) = p-value**

Base category= Tightening of farm security

Number of observation = 90
Log pseudo likelihood = 151.697
Wald chi^2 (13) = 30.798
Log likelihood = -151.697
Prob >chi^2 = 0.236
Pseudo R^2 =
Cox and Snell: 0.290
Nagelkerke: 0.334
McFadden: 0.169

These values describe the model of fit and significance of the predictors relative to the baseline category of early harvest of crops.

Following the approach of Chikezie et al. (2019), the results in Table 4.15 isolate factors affecting cassava farmers' choice of coping strategies relative to the base category, tightening of farm security. The discussion below emphasizes how the predictors distinguish alternative coping strategies from this base.

Access to credit strongly increases the likelihood of farmers adopting crop diversification (coef. 23.335, $p < 0.01$) and seeking assistance (coef. 19.598, $p < 0.01$) compared to tightening farm security. This suggests that farmers with better credit access prefer investment-intensive or collaborative coping mechanisms over solely securing their farms physically. Credit enables purchase of inputs and mobilization of support, confirming its critical role in conflict resilience as noted by Mutenje et al. (2022).

Extension visits positively affect the choice of tightening farm security (base) less than other strategies such as crop diversification or building fences, with a significant coefficient (0.078, $p < 0.05$). More frequent extension contacts encourage farmers' adoption of diverse coping strategies rather than reliance on farm security alone, highlighting the role of agricultural advisory in expanding coping options (Adepoju et al., 2021).

Farming experience significantly increases preference for crop diversification relative to tightening farm security (coef. 0.247, $p < 0.05$). Experienced farmers tend to diversify crops to spread risk, reflecting adaptive behavior beyond physical farm protection. This supports evidence that more experienced farmers adopt diversified strategies in conflict contexts (Chikezie et al., 2019).

Non-farm income negatively associates with choosing tightening farm security (coef. -2.864, $p < 0.01$) and early harvesting (coef. -1.646, $p < 0.05$), implying farmers relying on alternative incomes are less likely to invest heavily in securing farms or accelerating harvests. They may buffer conflict shocks through income diversification rather than intensified farm-level defenses, consistent with Ojo et al. (2023).

Higher asset values significantly increase the odds of farmers adopting crop diversification ($p = 0.023$) and building fences ($p = 0.024$) over tightening farm security. Asset-endowed farmers can afford more proactive and physical coping measures beyond just guarding, aligning with Lemo and Wana (2020) on assets enabling preventive strategies.

Age negatively influences the preference for tightening farm security (coef. -0.097, $p < 0.05$) and praying for peace (coef. -0.080, $p < 0.05$), showing older farmers tend to avoid physically demanding or spiritual strategies compared to younger ones. This may be due to labor constraints or differing coping outlooks, consistent with Umar et al. (2021).

Membership in cooperatives reduces the likelihood of tightening farm security (coef. -1.176, $p < 0.05$) as a coping choice, indicating cooperatives may not sufficiently support farm protection efforts, or members rely on other strategies.

Farm location dispersion significantly reduces early harvesting relative to farm security (coef. -18.516, $p < 0.01$), implying management difficulties across multiple locations hinder timely harvesting as a conflict response.

Finally, higher education increases preference for crop diversification (coef. 0.290, $p < 0.05$) relative to tightening farm security, showing educated farmers are more likely to adopt diversified and knowledge-based coping strategies (Chikezie et al., 2019; Bala et al., 2022).

In summary, compared to tightening of farm security, farmers with better access to credit, education, farming experience, and assets tend to prefer crop diversification and seeking assistance, while those with non-farm income are less focused on physical security. Extension services broaden coping choices beyond simple farm guarding. Older farmers and cooperative members show less inclination toward tight farm security. These dynamics emphasize the importance of integrated interventions—improving credit, education, extension, and asset accumulation—to shift farmers toward more diversified, effective coping strategies under farmer–herder conflict.

4.5.3 The test of null hypothesis II; Farm size, savings, access to credit, extension visit, farming experience, sex, primary occupation, age, membership of cooperative association, non-farm income, farms in different locations, land tenure, value of assets, and years of education do not significantly affect cassava farmers' choice of conflict coping strategies in the study area.

Based on Table 4.5.2, the following conclusions was drawn; the chi-square from the likelihood ratio statistics tests the overall significance of the multinomial model and assesses if the slope coefficients are simultaneously not equal to zero.

From the table, significant factors affecting certain coping strategies include:

Access to credit (X_3) is highly significant in crop diversification and seeking assistance ($p < 0.01$).

Extension visits (X_4) significantly influence tightening of farm security ($p < 0.10$).

Farming experience (X_5) significantly affects crop diversification ($p < 0.05$).

Non-farm income (X_7) significantly influences tightening of farm security ($p < 0.01$) and early harvesting ($p < 0.10$).

Value of assets (X_8) significantly influences crop diversification and building of fences ($p < 0.05$).

Age (X_9) shows significance in tightening of farm security and praying for peace ($p < 0.10$).

Membership of cooperative (X_{10}) influences tightening of farm security ($p < 0.10$).

Farms in different locations (X_{11}) significantly affects early harvesting ($p < 0.01$).

Years of education (X_{13}) have a significant effect on crop diversification ($p < 0.10$).

Other factors, such as farm size, savings, sex, land tenure, and many of the other variables, do not show significant influence on the choice of coping strategies.

This implies the null hypothesis that all these factors do not significantly influence coping strategy choice is generally rejected for some variables, like access to credit, extension visits, farming experience, non-farm income, and a few others, but retained for others.

This agrees with findings by Cong and Yao (2021), who emphasize that some socio-economic factors do influence coping strategies. Gujarati and Porter (2009) discuss likelihood ratio statistics as a method to test the simultaneous influence of model coefficients.

Other studies echo this nuanced influence of socio-economic factors on coping mechanisms. For instance, Deressa et al. (2010) used multinomial logit to show specific factors influence coping choices in climate events. In agricultural conflict and coping contexts, Farmakinwa et al. (2022) note that strategies like tightening farm security and seeking assistance vary by socio-economic characteristics. Psychological and cultural factors also influence coping strategy choices (Nguyen, 2020; Aldwin, 2021).

This analysis indicates that some socio-economic factors significantly affect cassava farmers' coping strategy choices, the influence is not uniform across all factors listed in the hypothesis, and the likelihood ratio test validates the joint significance of selected factors in this multinomial model

The rejection of the null hypothesis here underscores that farmers' coping strategies are shaped by resource availability and institutional support.

4.5.1 Food Security Status of the Cassava Farmers

The result of the food security status of the cassava farmers in the study area is presented in table 4.16 and 4.17 below.

Table 4.16 Food Security Status of the Cassava Farmers Based on Body Mass Index (BMI)

Benchmark	Body Mass Index (BMI)	Frequency	Percent
<18.5	Under weight	87	96.7
18-25	Normal weight	3	3.3
	Total	90	100

Source: Field Survey 2025

The Body Mass Index (BMI) statistics indicate a severe malnutrition crisis among cassava farmers. 96.7% of the cassava farmers are underweight, while only 3.3% fall within the normal weight category. These findings point to a severe nutritional crisis, confirming the persistence of chronic energy deficiency among smallholder farmers in Nigeria. Such prevalence of underweight status is consistent with the broader food security challenges documented in Nigeria, where the Global Hunger Index ranked the country 103rd out of 121 nations in 2022, indicating a "serious" level of hunger (Global Hunger Index, 2022; UNICEF, 2023). Such an extensive degree of underweight status suggests chronic energy deficiency and inadequate nutrient intake (Gibson, 2005).

4.5.2 Food Security Status of the Cassava Farmers based on individual dietary diversity score (IDDS)

Table 4.17 Food Security status of the Cassava farmers based on Individual Diversity Score (IDDS)

Individual Dietary Diversity Score (IDDS)

IDDS	Frequency	Percent
Low	26	28.9
High	64	71.1
Total	90	100.0

Source: Field Survey 2025

The Individual Dietary Diversity Score (IDDS), is often used as a proxy for food security, assuming more diverse diets indicate better nutrient intake (Kennedy, Ballard, & Dop, 2011).

The Individual Dietary Diversity Score (IDDS) results suggest that the majority of cassava farmers (71.1%) attained high dietary diversity (IDDS ≥ 30), while only 28.9% had low dietary diversity.

Table 4.18 Overall Food security Status of the Cassava Farmers based on the two indicators use (BMI & IDDS)

Food Security Status	Frequency	Percent
Severely Food Insecure (<21)	26	28.9
Moderately Food Insecure (21-35)	44	48.9
Food Secure (>35)	20	22.2
Total	90	100

Source: Field Survey 2025

The result above shows that the minority (28.9%) of respondents have severely food insecure IDDS and the majority (48.9%) of the respondents have moderately food insecure IDDS and 22.2% of the respondents are food secured. This positive dietary profile, however, did not translate into nutritional sufficiency, as evidenced by the overwhelmingly low BMI. Similar observations have been reported in recent studies, where dietary diversity was found to be an insufficient predictor of nutritional outcomes in agrarian populations (Amao *et al*. 2023).

The overall result of the insecurities reflects the limitations of BMI as a sole indicator of nutritional adequacy, since it fails to capture micronutrient deficiencies or the quality of food consumed. The divergence between BMI and IDDS in this study is consistent with recent scholarship emphasizing the need for a multidimensional approach to food security measurement, integrating anthropometric, dietary, and socioeconomic indicators (Barrett, 2010; Arigbo & Agbo, 2024). The high levels of food insecurity are consistent with the observed severe malnutrition and point to systemic issues affecting food availability, utilization, accessibility and stability for farming individuals despite being producers of cassava- a staple food crop.

Overall, these findings indicate that cassava farmers in the study area face a conflicting food security crisis, where high dietary diversity does not reflect the physique of the surveyed farmers. This reflects the broader need for further investigation using a more holistic approach to assess food security of the cassava farmers who face the threat of the herders in the study area, with UNICEF (2023) projecting that up to 25 million Nigerians were at risk of hunger by 2023, an increase of 8 million from 2022. In line with previous literature, the study confirms that food security interventions in cassava-based systems must go beyond production to incorporate nutrition-sensitive strategies, access to diverse and nutrient-dense foods, and improved rural infrastructure (FAO, 2023; Otekunrin & Sawicka, 2019).

4.6 Factors Affecting the Food Security of the Cassava Farmers

Tables 4.18: Parameters of the Ordered Probit Regression with Robust Standard Error

Food Security Variables	Coefficients	P-Values	Significant Effect Direction
Sex	-.4244542	0.137	Negative
Years of Education	.0245514	0.431	Positive
Household Size	.0097429	0.883	Positive
Age	-.0062776	0.720	Negative
Farm Experience	-.0214959	0.200	Negative
Mem. Cooperative	-.2871957	0.323	Negative
Num. of Ext. Visit	.0050737	0.775	Positive
Access to credit	1.713963**	0.016	Positive
Farmers' Income	-4.26e-06**	0.052	Negative
Land Ownership	.1700989	0.568	Positive
Conflict Factor	-.2156678	0.315	Negative
Farm Size	.7023006	0.163	Positive

Source: Field Survey Data, 2025 Notes: **= Significant at 5%

No of Obs =90
LR Chi2 (12) =20.15
Pro>Chi2 = 0.0642
Pseudo R2 =0.0967
Log Likely = –94.131511

A positive coefficient means that an increase in the independent variable will lead to an increase in the dependent variable QED. All things being equal when sex increases by one unit (that is. From zero addition to female numbers to one addition to male numbers, the expected change in the log-odds of being in a higher level of food secured decreases by 0.4244542 or 42%.

Years of education has a positive coefficient (0.0245514), which implies that an additional one year of school can increase the probability of being food secured by 0. 0245514 unit.

Household size with a positive coefficient (0.0097429) implies that an additional number of household size by one member will increase the food security by 0.0097429 unit.

The extension visit with coefficient is positive (0.0050737), this implies that an addition of one extension visit can increase the probability of the cassava Farmers' food security by 0. 0050737 unit and this is in line with a priori expectation

The coefficient of the credit access is positively high (1.713963), it implies that an addition of having one credit access can increase the probability of the cassava farmers' food security by 1.713963 and it is in line with the a priori expectation.

Land ownership with positive coefficient of (0.1700989), implies that an addition of land ownership can increase the food security of the cassava farmers by 0.1700989 unit and this is in line with the a priori.,

Farm size with significant coefficient (0.7023006) implies that one addition of a hectare for cassava cultivation will increase the food security of the cassava farmers' by 0.7023006 and this is in line with the a priori.

Sex with coefficient (-0.4244542), age with coefficient (-0.0062776), years of farming experience with coefficient (-0.0214959), Membership of cooperative organization with coefficient (-0.2871957), farmers' income with coefficient (-4.26e-06), and conflict factor with coefficient (-0.2156678) have negative coefficient which implies that an increase in these variables will lead to a decrease in in the farmers' food security and this is against the a priori expectation.

The ordered probit model revealed that access to credit was the major determinant of food security, while other factors such as age, sex, farm size, and education were not statistically significant. Farmers' income showed a negative but statistically insignificant effect on food security.

Access to Credit (Coefficient = 1.714, p = 0.016): This variable is positively and significantly associated with food security. Access to credit likely enables farmers to invest in production inputs, thus improving their food security status. This aligns with the findings of Adams, Grummer-Strawn, and Chavez (2003) and FAO (2009), who highlight credit access as crucial for agricultural productivity and food security.

Farmers' Income (Coefficient = -4.26e-06, p = 0.052): Surprisingly, farmers' income has a negative and significant effect at the 5% level. This finding might indicate complex dynamics such as income not fully translating to food security possibly due to high expenses or income volatility. Mason (2002) and Martins-Shields and Stojetz (2019) underscore that income alone may not guarantee food security without stability and adequate resource allocation.

Other Variables (Sex, Education, Household Size, Age, Farm Experience, Membership in Cooperatives, Number of Extension Visits, Land Ownership, Conflict Factor, Farm Size): These variables show coefficients with expected signs (e.g., positive for education, farm size; negative for sex, age, conflict factor), but none are statistically significant at conventional levels. The negative sign on conflict factor (-0.216) suggests farmer-herder conflict reduces food security, consistent with Baumann and Kuemmerle (2016) and more recent studies by Armghan et al. (2022) and Martins-Shields and Stojetz (2019) who identify conflict as a destabilizing force for food production and security. However, the lack of significance here indicates the need for further investigation or larger samples.

4.6.1: Marginal Effects of Farmer-Herder Conflicts on Individual Cassava Famers' Food Security

Table 4.19 presents the estimated marginal effects and P-values from the ordered probit model

Table 4.19 Marginal effects of order probit regression of farmer-herder conflicts on individual cassava farmers' food security

Variables	**Low Food Secured**		**Marginal Food Secured**		**High Food Secured**		**Very Low Food Insecured**	
	dy/dx	P>Z	dy/dx	P>Z	dy/dx	P>Z	dy/dx	P>Z
Sex	.1479395	0.126	-.0457025	0.156	-.0613849	0.149	-.0408522	0.177
Yrs. Of Edu.	-.0085572	0.428	.0026435	0.437	.0035506	0.435	.002363	0.445
HH Size	-.0033958	0.883	.0010491	0.882	.001409	0.883	.0009377	0.883
Age	.002188	0.720	-.0006759	0.722	-.0009079	0.721	-.0006042	0.721
Farm Exp.	.0074922	0.189	-.0023145	0.205	-.0031088	0.199	-.0020689	0.252
Mem. of Coop.	.1000994	0.318	-.0309234	0.334	-.0415344	0.329	-.0276416	0.346
Ext. Visit	-.0017684	0.775	.0005463	0.776	.0007338	0.776	.0004883	0.776
Credit Access	-.5973856**	0.013	.1845484**	0.061	.2478744**	0.027	.1649627**	0.04
Farmers' Income	1.48e-06**	0.041	-4.58e-07**	0.061	-6.16e-07**	0.067	-4.10e-07	0.104
Land Ownership	-.0592864	0.566	.0183151	0.570	.0245998	0.570	.0163714	0.574
Conflict Factor	.075169	0.308	-.0232217	0.320	-.03119	0.321	-.0207573	0.340
Farm Size	-.2447803	0.154	.0756192	0.184	.1015672	0.170	.0675939	0.205

Source: Estimated Field Survey 2025, Note: dy/dx implies a marginal effect

Marginal Effects of Farmer-Herder Conflicts

Table 4.6.5 details marginal effects of variables on different food security categories (Low, Marginal, High Food Security, Very Low Food Insecurity):

Access to Credit: Significantly reduces the probability of being in the "Low Food Security" category (-0.597, p=0.013) and increases the likelihood of "Marginal" (0.185, p=0.061), "High" (0.248, p=0.027), and "Very Low Food Insecurity" (0.165, p=0.04) categories. This reinforces the pivotal role of credit access in improving food security levels (FAO, 2009; Armghan et al., 2022).

Farmers' Income: Positively affects "Low Food Security" category but with very small magnitudes (1.48e-06, p=0.041), and negatively affects higher food security categories. This confirms the earlier paradoxical income result, emphasizing that mere income magnitude doesn't guarantee food security (Mason, 2002).

Conflict Factor: The marginal effects, though not statistically significant, reveal a positive association with "Low Food Security" (0.075, p=0.308) and negative associations with higher security categories, supporting the concept that conflict increases food insecurity risks, as established by Baumann and Kuemmerle (2016), Martins-Shields and Stojetz (2019), and Rizov et al. (2015).

Other Factors: Variables like sex, education, household size, age, farm experience, land ownership, and farm size have expected directional effects but remain insignificant, which corresponds with similar findings in the literature (UN 1975; World Food Summit 1996; Szabo et al. 2016; FAO 2007).

Implications

The significant positive effect of credit access confirms its crucial role in addressing food insecurity, allowing farmers to purchase inputs, adopt innovations, and smooth consumption (FAO 2009; Armghan et al. 2022).

The negative coefficient for income suggests that income increases must be stable and sufficient to translate into food security; otherwise, food insecurity may persist due to other barriers (Mason 2002; Martins-Shields and Stojetz 2019).

The farmer-herder conflict factor's negative coefficient (though insignificant) and marginal effects emphasize the importance of conflict resolution for securing stable food systems. Past studies highlight that conflicts disrupt farm activities, reduce production, and force abandonment of farms, worsening food availability and access (Baumann and Kuemmerle 2016; Adebayo et al. 2016; Olagunju et al. 2016; Ubokudom et al. 2017).

Non-significant variables suggest underlying complexities in food security dynamics that multi-dimensional interventions must address, including education, cooperative membership, extension services, and land tenure security (Lampietti et al. 2011; Manikas et al. 2023).

4.6.2 The test of null hypothesis III; Sex, years of education, household size, age, farming experience, membership of cooperative association, number of extension visit, access to credit, farmers' income, land ownership, frequency of conflict, and farm size do not significantly affect cassava farmers' food security in the study area.

Based on tables 4.20 and 4.21, the following conclusions were drawn: the chi-square from the likelihood ratio statistics tests the overall significance of the ordered probit model and assess if the slope coefficients are simultaneously not equal to zero.

From the two tables, the analysis indicates that while some socio-economic factors significantly affect the food security of the cassava farmers, the influence is not uniform across all the factors listed in the hypothesis, and the likelihood ratio test validates the joint significance of selected factors in the ordered probit model. The partial rejection of the null hypothesis here underscores that farmers' food security is influenced by the effect of the conflict frequency and by some structural factors like farm size and farmers' income. The model's pseudo R^2 (0.097) shows moderate explanatory power typical for cross-sectional food security studies. The LR Chi2 p-value (0.064) suggests marginal model significance.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 SUMMARY OF FINDINGS

This study investigated the socioeconomic characteristics of cassava farmers, the causes of farmer–herder conflicts, their coping strategies, and the effects of such conflicts on cassava production, income, and food security in Imo State. Data collected from 90 respondents were analyzed using descriptive statistics, OLS, multinomial logistic regression, and ordered probit regression.

Socioeconomic Findings: A larger proportion (58.9%) of cassava farmers were female, confirming that women dominate cassava production in the region. Most respondents were married (92.2%) with an average household size of six, suggesting family labor availability. The majority had some level of formal education and belonged to cooperative associations, enhancing access to information and resources. Average farming experience was 12 years, indicating accumulated production knowledge and adaptability.

Causes of Farmer–Herder Conflicts: Conflicts were primarily triggered by cattle encroachment and crop destruction, competition for land and water, open grazing practices, and lack of government regulation. Environmental stress, population pressure, and weak land tenure systems also aggravated disputes between herders and farmers.

OLS Regression Findings: Marital status, level of education, farm size, household size, and farming experience significantly affected cassava farmers' net income, while age, sex, conflict frequency, and land damage were not significant. The model confirms that economic and social capital variables are stronger predictors of income than demographic characteristics.

Coping Strategies and Multinomial Regression Results: Descriptive analysis showed that the most adopted coping strategies were crop diversification (mean = 2.63), building fences (mean

= 2.36), praying for peace (mean = 1.77), and tightening farm security (mean = 1.71). Crop diversification and fencing were rated the most effective. The multinomial regression model revealed that access to credit ($p<0.01$) and farming experience ($p<0.05$) significantly influenced coping strategy choices, while farm size and education had positive but non-significant effects.

Ordered Probit Regression Findings: The ordered probit model showed that access to credit (coef = 1.714, p=0.016) positively and significantly affected food security. Farmers' income (coef = -4.26e-06, p=0.052) had a negative but significant effect, implying income volatility. Variables such as years of education, household size, farm size, and land ownership had positive but non-significant effects. Sex, age, and conflict frequency had negative coefficients, indicating vulnerability of male and older farmers to food insecurity under conflict stress.

5.2 CONCLUSION

The study concludes that farmer–herder conflicts have significantly undermined cassava farmers' productivity, income stability, and food security in Imo State. Socioeconomic characteristics such as education, cooperative membership, and farming experience remain crucial for improving adaptive responses. Coping strategies like crop diversification and fencing proved most effective, while reliance on prayer and local leaders had limited impact. The empirical results confirm that credit access and farming experience are vital for resilience, and that farmer–herder conflicts indirectly perpetuate food insecurity despite farm income improvements.

5.3 RECOMMENDATIONS

1. The government should establish state and community-based early warning and conflict resolution mechanisms involving farmers, herders, and traditional leaders.

2. The government should expand access to low-interest agricultural credit to enable farmers to adopt resilient practices and invest in protective infrastructure.

3. The government should Implement and enforce land use and grazing policies to delineate farming and grazing areas, reducing encroachment and disputes.

4. The ministry of Agriculture should strengthen agricultural extension services to educate farmers on sustainable coping strategies, modern conflict management, and climate-smart agriculture.

5. The ministry of Agriculture should empower women farmers through targeted training, cooperative support, and leadership inclusion, recognizing their dominant role in cassava production.

6. The federal Government should promote post-conflict rehabilitation programs that stabilize livelihoods, diversify income sources, and ensure consistent food access for conflict-affected households.

5.4 CONTRIBUTION TO KNOWLEDGE

- The study provides a new econometric linkage between farmer–herder conflict, coping strategies, and food security using both multinomial and ordered probit regression models.
- It identifies access to credit as a dual-function factor improving both coping capacity and food security—an empirical contribution specific to Imo State cassava farmers.
- The finding that increased farm income does not automatically ensure food security under conflict conditions introduces a new perspective to conflict–livelihood dynamics.
- The research highlights female predominance in cassava farming as a resilience factor, emphasizing gender-based intervention for conflict adaptation.

- It establishes a model framework applicable to other conflict-prone agricultural zones in Nigeria, integrating socioeconomic and econometric insights for policy formulation.
- The study quantifies coping strategies such as crop diversification and fencing as statistically verifiable adaptive mechanisms to conflict shocks, bridging empirical and policy gaps in resilience economics.

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APENDIX 1

QUESTIONNAIRE ON EFFECT OF FARMERS-HERDERS CONFLICTS ON FOOD SECURITY OF CASSAVA FARMERS IN ABIA STATE, NIGERIA.

Dear Respondent,

I am an MSc student of the Department of Agricultural Economics, at the Federal University of Technology Owerri, Imo State, Nigeria. I am carrying out academic research on the above-named topic. Please answer the question in each section of this questionnaire to the best of your knowledge. Try to be as truthful as possible as the information provided is strictly confidential and this questionnaire is strictly for this research only.

Obasi, Akanele C.
Student / Researcher

Section A: Socio-economic characteristics of the respondents (cassava farmers)

Kindly fill or tick ☐ accordingly

1. What is the name of your community? .....
2. What is your age? …….
3. Please Tick your sex, Male ☐ Female ☐
4. What is your marital status? Married ☐ Single ☐ Divorced ☐
5. What is your household size? …….
6. What is your height and weight? ……
7. What is the highest level of education attained? No Formal ☐ Primary ☐ Secondary ☐ Tertiary ☐
8. Do you belong to any cooperative society? Yes ☐ No ☐
9. How many social organizations do you belong to? ……..
10. What is your major occupation? Farming ☐ Trading ☐ Cattle Herding ☐ Craft/artisan ☐ Government salary job ☐ Private salary job ☐ Others specified …….
11. If your major occupation is not farming, mention the occupation …….
12. For how long have you been farming? .....
13. How many plots of farm lands did you cultivate cassava this year? One ☐ more than ☐
14. If your answer to no. 12 above is more than one plot, what are their sizes …….
15. Do you cultivate crops other than cassava? Yes ☐ No ☐

16. If your answer to no. 15 above is yes, mention them
    ……..

17. What is the type of land ownership use for your cassava cultivation? Owned ☐ rente☐

18. Have agricultural extension agents visited you before? Yes ☐ No ☐

19. If your answer is yes at no. 18, how many times did they visit you in a year?
    …….

20. Do you have access to any agricultural credit facility? Yes ☐ No ☐

21. Which level of farming do you practice? Subsistence ☐ Otherwise ☐

22. If your answer to no. 21 above is subsistence, do you sometimes sale from the leftover? ……

23. Which type of labour do you involve in your farm? Family ☐ Hired ☐

24. If your answer to no. 23 above is hired labour, what is the wage rate?
    ……

Section B: Remote and immediate causes of these farmers-herders conflicts

25. What are the remote and immediate causes of conflict between farmers and herders in your community, please tick where appropriate.

	Perceived remote causes	Very Serious	Serious	Not Serious
A	Competition for land resource			
B	Competition for water resource			
C	Low rainfall			
D	Decline in grassland			
E	Ineffective government policy implementation			
F	Over-grazing of fallow land			

Any other please specify……..

	Perceived immediate causes	Very Serious	Serious	Not Serious
A	Destruction of farmland/farm crops by the cattle herders			
B	Killing of cattle by the farmers			
C	Theft of cattle by indigenes of the community			
D	Sexual harassment of the female farmers by the herders			
E	Indiscriminate bush burning			

Any other please specify……..

26. Have you experienced any farmer-herder conflict before? Yes ☐ No ☐
27. How many times does the conflict happen in a month? ……..
28. What form does the conflict take? ……..
29. Have these conflicts increased over the years? ……
30. Are there specific areas where conflicts are more prevalent?
    ……

Section C: The effect of these conflicts on the cassava production on the net income

Returns

S/no	Returns items	Unit of Measurement (basket, wheel barrow, bags, and Bundle)	Quantity harvested	Sales Price	Total Amount
1.	Tubers (kg)				
2.	Cassava stems cutting (50 sticks per bundle)				

Costs

Fixed Costs

S/no	Farm inputs	Cost price (₦)	Depreciation (₦)	Useful life	Scrap Value (Salvage value)
1.	Cutlass				
2.	Hoe				
3.	Shovel				
4.	Wheelbarrow				
5.	Files				

Variable Costs

S/no	Farm variable input	Cost price (₦)	Unit of measurement	
	Cassava Stems cutting (50 sticks per bundle)			

	Fertilizers (organic & inorganic) Pesticides/herbicides			

Labour Cost

Type of farm labour	Number of hours	Wage rate	Amount paid (₦)
Land preparation Planting Weeding Fertilization Harvesting			

Section D: Identify the various Coping Strategies and Factors Influencing the Choices of managing the conflicts and tick the ones you employed.

31. What are the various coping strategies employed and the factors influencing your choices in managing the conflicts?

No.	Perceived coping strategies	Very Effective	Effective	Not Effective
1.	Crop diversification (mixed cropping)			
2.	Tightening farm security			
3.	Early harvest of crops			
4.	Seeking assistance from local leaders			
5.	Praying for peace			
6.	Building of fences			

Any other please specify……..

32. What strategies do you best employ to cope with farmer-herder conflicts?
……..
33. What factors influence your choice of coping mechanisms?
……..

Section E: Food Security Status of Cassava Farmers
Individual Dietary Diversity Score (IDDS)

S/no.	Type of food consumed	Unit of Measurement(table spoon, slices, serving plate, tin, sachet, cup, grounded, number, pieces, etc.)	Quantity Consumed at a Time	Frequency of Consumption Per Day
1.	Cereals (rice, etc)			
2.	Milk			
3.	Fruits and Vegetables			
4.	Meat, poultry, offal			
5.	Tubers/roots			
6.	Eggs			
7.	Fish and Seafoods			
8.	Pulses, Legumes, nuts			

Section F: Effect of farmers-herder conflicts on the food security of the cassava farmer and Factors that Affects Food Security

34. In what ways have farmer-herder conflicts affected your food availability? …….
35. Have you experienced food shortages or changes in dietary patterns due to these conflicts? ……..
36. **Perceived Factors that Affect Cassava Farmers**

Perceived Factors	**Yes**	**No**
Gender of household		
Years of educational attainment		
Household size (no. of people living in a house)		
Age (years)		
Farming experience (years)		
Membership of Cooperative Society		
Number of extension contacts per annum		
Access to credit		
Income		
Farm size		
Land ownership		
Experience of farmer-herder conflict		

Any other please specify……..