THE SYNERGIES AND TRADEOFFS THAT EXIST BETWEEN CASHEW PRODUCTION AND FOOD SECURITY IN THE BONO AND BONO EAST REGIONS OF GHANA

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DECLARATION

I, YVETTE DONKOR BONSU, do hereby declare that except for the references cited, which have been duly acknowledged, this thesis title, "THE SYNERGIES AND TRADEOFFS THAT EXISTS BETWEEN CASHEW PRODUCTION AND FOOD SECURITY IN THE BONO AND BONO EAST REGIONS'' is the result of my own research. This thesis has never been presented either in whole or in part for any other degree of the University or elsewhere.

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ABSTRACT

Over the last decade, the Bono, Bono East regions, affectionately referred to as Ghana's breadbaskets due to their contribution to food crop production, are gradually shifting into cashew nut production by the majority of farmers. This is concerning because it poses a threat to farmers' food security by reducing the output of food crops. Some school of thought argue that, the income generated from the sale of cashew nuts can be used by farmers to purchase food in the local market and undertake crop diversification. However, there isn't much research to prove this assertion. Hence, the need to analyse the tradeoffs and synergies that exists between cashew production and food security. A mixed methods approach was employed to assess synergies and tradeoffs that exist between cashew production and food security. This was achieved through the following specific objectives i) analysis of how food crops produced by cashew farmers contribute to food security based on availability, accessibility, utilization and stability ii) analysis of the determinants of food security as well as strategies developed by the farmers to reduce their vulnerability and lastly, examining the tradeoffs and synergies between cashew production and food security. The study was conducted in the Bono and Bono east regions using 240 cashew farmers identified through multistage sampling. Months of adequate household food provisioning (MAHFP) was used in analyzing availability, Household Food Insecurity Scale (HFIAS) was used to analyse accessibility, Household Dietary Diversity Score (HDDS), Women Dietary Diversity Score and Child Dietary Diversity Score were also used to assess utilization. Stability was measured using the perception of the seasonality of food items in the household and market with respect to market price, crop failure, drought etc. Analysis for the study was conducted using STATA 14. The Tobit regression model was used to assess the determinants of food security while the Structural Equation Model was used to analyze the tradeoffs and synergies that exists between cashew production and food security. According to the findings of the study, farmers had food available for 10 months out of the entire year. This means that cashew farmers do not have enough food at certain times of the year. This situation mostly occurs during May – July which is considered as the lean season. Results of food accessibility also showed a mean of 2.96 out of 27. Results of food utilization showed that farmers consumed about 9 food groups out of the 12 food groups assessed. Results of cashew farmer's food stability shows that farmers are strongly affected by changes in food prices, drought and crop failure. Prominent factors that affect food security include age, household size, household expenditure, education, income and access to markets. In analyzing the tradeoffs and the synergies that exists between cashew production and food security, the study identified the tradeoffs involve the negative relationship between income and food security as well as the negative relationship that exists between food accessibility and food security. Some synergies identified include the positive relationship between cashew production and income and food availability and food security. The study therefore, recommends that the crops division of the ministry of food and agriculture should engage in sensitization and awareness programs to encourage cashew farmers to increase crop production to make more food available for the household. Also, MoFA should support the diversification of crops on the farm to improve the nutritional diet of farmers as well as engage in the development of alternative sources of income. Furthermore, the ministry of food and agriculture should educate cashew farmers on the effect of some determinants of food security such as the importance of family planning as well as the need for farmers to have a higher form of education to improve their living conditions.

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LIST OF ACRONYMS

ADRA	Adventist Development and Relief Agency
CAPEAG	Cashew Processors and Exporters Association
CDDS	Child dietary diversity score
CIAG	Cashew Industry Association of Ghana
CRIG	Cocoa Research Institute of Ghana
FGD	Focus Group Discussion
FSNMS	Food security and Nutrition Monitoring System
GIZ	The Deutsche Gesellschaft für Internationale Zusammenarbeit
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
MAHFP	Months of Adequate Household Provisioning
MoFA	Ministry of Food and Agriculture
RCS	Reduced Coping Strategy
SEM	Structural Equation model
USAID	United States Agency for International Development
WDDS	Women dietary diversity Score

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF STUDY

Ghana's agriculture sector employs about 29% of the workforce and accounts for about 23.1% of the national gross domestic product (Atta, 2022). Some of the major crops that are cultivated in Ghana include maize, yam, cassava, rice, cocoa, oil palm, cotton, rubber, tobacco, shea nut, sugar cane and varieties of fruits and vegetables based on the different agro-ecological zones. A key source of foreign exchange revenue is the production of cash commodities such as cocoa, sheanut, and coffee. Nontraditional crops like cashew nuts, pineapples, and mangoes, on the other hand, are becoming extremely essential to the economy of Ghana (ACI, 2010). This is a result of the fall in conventional export crops' revenue hence the non-traditional industry becoming a significant foreign exchange earner to supplement the traditional sector's earnings (GEPA, 2015).

The Brong Ahafo region, which is presently separated into the Bono, Bono East, and Ahafo regions, is one of Ghana's regions that produce both cash crops and food crops. Some food crops produced include maize, plantain, yam, tomatoes, pepper, cassava, groundnut, sorghum, cocoyam, bambara beans, cowpea, okro, and garden egg (SRID, 2015). Food crops from the Bono, Bono East, and Ahafo regions are predominantly consumed in the urban areas, indicating the region's importance for the country's domestic food security. Apart from the food crops, one of the major cash crops grown in the region was cocoa. In the Bono Ahafo Region, cocoa was the most important cash crop (Peprah *et al.*, 2018). This was due to the market price of cocoa beans remaining steady. Over a period of time, cocoa production in the region has decreased as a result of factors such as low-yielding varieties, ageing cocoa plants, and climatic changes. In addition, other factors such as high erratic farm input prices, ageing cocoa farmers,

technological backwardness, and illegal chain saw activities. Based on the aforementioned challenges, majority of cocoa farmers have switched from the production of cocoa to cashew production. Cashew is one of Ghana's non-traditional export crops that has been given a boost by the government since its introduction in the 1960s. This is part of the government's strategy to diversify export-based crops in order to boost international trade and achieve export-oriented growth (GoG, 2000).

In 2020, the government distributed approximately five (5) million cashew seedlings to both cashew and non-cashew farmers as part of the Planting for Export and Rural Development (PERD) program (African Cashew Alliance, 2020). Currently the majority of cashew that is produced in Ghana emanates from the Bono and Bono East regions of Ghana. According to literature, cashew nut cultivation is among the tree crops that is gaining widespread recognition among farmers in these regions (Evans, Mariwah and Antwi, 2015; Peprah *et al.*, 2018). The interest in cashew began when the Ministry of Food and Agriculture (MoFA) undertook a study to ascertain if indeed Ghana had a good potential for cashew production, and the results indeed showed that the country had enough lands available for increased production, especially in the Bono, Bono East and Ahafo regions as well as the Northern Region (GoG, 2000). Some efforts made by the government to boost cashew production in Ghana include the development of the Cashew Development Project. The project contributed to a significant rise in raw cashew nut production, which increased from 6.33 tonnes in 2003 to about 34.63 tonnes in 2006 and then to 81.19 tonnes in 2008 (Sarpong, 2011). There has been a further increase in the production of cashew from 81.190 tonnes in 2008 to 91,200 tonnes in 2018 and currently, production is between 110,000 tonnes and 130,000 tonnes in 2021 (African Cashew Alliance, 2021).

Some developmental agencies have also supported the increase in cashew production including Techno serve, USAID, ADRA, GIZ etc. The increase in output has also resulted in an increase in Ghanaian cashew exports. Cashew nut exports accounted for roughly 53% of overall export

earnings in 2016, generating $371.1 million from non-traditional agricultural exports in Ghana (ISSER, 2016). It also surged exports to 43.84 percent generating $378.21 million in 2018 (Ghana business news, 2019). Though the expansion of cashew production is good in relation to high incomes for the farmer and high export earnings for the country, it has a probability of affecting the farmer's food security in the long term. This is because there is the possibility of cashew farmers dedicating more land to cashew production while reducing the land allocation for food crop production. This action can result in a reduction in quantity of food crops obtained from the farm and thereby affecting the farmer's food security.

Food security is defined as having physical and economic access to sufficient, safe, and nutritious food that satisfies one's dietary needs and preferences in order to live a healthy and active life (World food summit, 1996). From the definition above food security can be broken down into six (6) pillars. This includes availability, accessibility, utilization, stability, sustainability and agency. These six pillars ensure that farmers are food secure however, the increase in cashew production is likely to affect these pillars of food security as explained above.

There are divided opinions by scholarly articles with regard to the usage of cash crops such as cashew to attain food security. On the global scene, there have been several concerns with regard to the usage of this method. This was expressed by Babu *et al.* (2014) and Kahane *et al.* (2013) that the increase in cash crop production in lands where food is traditionally grown can have a serious impact on food security. However, in Africa what is observed is contrary to global concerns. Hashmiu *et al.* (2022) highlighted that especially in South Saharan Africa there have been efforts by development agencies and governments to promote cash crop production as a strategy to improve food security. This is the current situation in Ghana as there is a growing shift from the production of food crops to the cultivation of cashew. This poses a threat to farmers as farmer's own food production is not adequate to feed themselves and their

households. This will mean that farmer households will have to rely on the market and this can affect their nutritional status as a result of the heavy dependence on the market. To add to the statement on how cashew nut production may negatively influence food security, it was also discovered in literature that those who make the transition from food crop production to cash crop cultivation are more likely to experience several changes at home. This includes changes in the frequency and amount of household incomes, as well as increased vulnerability to food price changes etc. (Achterbosch *et al.*, 2014).

1.2 PROBLEM STATEMENT

Food security is an important developmental issue that every developing country seeks to address especially in the agricultural sector in Ghana. According to Evans *et al.* (2014), in recent years, much of the agricultural land in the Bono and Bono East regions have gradually been drifting away from the cultivation of food crops towards cashew nut farming. This is attributed to the high global cashew demand, which is predicted to grow by 7% each year, as well as the large profits made from the selling of raw cashew nuts.

This increase in cashew production for the export market is part of the plan by the government to develop agriculture in Ghana. However, this situation is quite worrisome as this poses a threat to farmer's household food security and eventually long-term food security issues for the country. This is because as cashew production increases, there is a possibility that the land allocated to the food crops will reduce and thereby causing cashew farmers to have issues with food.

This argument is based on the fact that cashew is cultivated for export rather than consumption, hence a cashew farmer's food security will be dependent on the food crops grown. If the quantity of food crops planted is reduced as a result of increased cashew production, the farmer's food security status is likely to suffer as well.

Also, when land allocated to food crops reduces, the various components of food security will

be affected such as food availability, accessibility, utilization and household food stability. Food availability in the household is obtained from the farmer's own food production. Therefore, lower production levels will have an impact on food production and food availability (Mockshelli *et al.*, 2018). Food accessibility depends on physical and economic access to food. This may also be affected as a result of farmers' inability to produce enough for the market, resulting in high food costs and cashew farmers' inability to buy or obtain food due to lack of resources. This is iterated by Sakyi (2012) that market purchases are influenced by the cost of food and the income available to the household. Food utilization may also be affected whereby cashew farmers as a result of the reduction in food crop production will resort to cheaper food group varieties resulting in low dietary diversity. This is supported by Sibhatu and Qaim (2017), who stated that during the lean season, when there isn't much food available, farmers' diet differs from when there is enough of food available. Stability may also be affected when cashew farmers are unable to have enough food available at all times of the year.

This can also be argued that this situation can be resolved through high income generated from the sale of raw cashew nuts which can be used in the purchase of food in the local market as well as undertaking crop diversification. However, there is limited literature to support this narrative on whether income generated from cashew production is invested into food crops or ploughed back into the cashew business.

Also, while cashew production might raise living standards, diverting land away from food crops can lead to increased food insecurity and chronic poverty, particularly among women and children. According to Hill (2014), an increase in cash crops has an impact on women's agricultural participation as well as children's nutritional diversity. This is due to factors such as the amount and frequency of household incomes, increased reliance on local markets, and increased vulnerability to variations in food prices.

Furthermore, there is a gap in the literature on food security analysis conducted to examine the

tradeoffs and synergies that exist between food security and cashew production, as well as gaps in the literature on food security analysis conducted to assess the factors that determine food security in cashew-producing households.

Based on the above narratives, the study seeks to carry out an in-depth food security analysis on cashew farmers in the study area and also find out indeed the synergies and tradeoffs that exist between cashew production and food security. Based on this, the study seeks to respond to the following key research questions.

RESEARCH QUESTIONS

1. How do the food crops produced by cashew farmers contribute to food security?
2. What are the determinants of food security and strategies developed by farmers to reduce their vulnerability?
3. What are the food security pillars and their relationships with cashew production?

1.3 OBJECTIVES OF THE STUDY

Main Objective

The main objective is to analyze the tradeoffs and synergies that exist between cashew production and food security.

Specific Objective

1. Analyze how food crops produced by cashew farmers contribute to food security based on four pillars (availability, accessibility, utilization, and stability)
2. Analyze i) determinants of food security and ii) strategies to reduce farmer's vulnerability of food insecurity.
3. Examine the food security pillars and their relationships with cashew production.

1.4 RELEVANCE OF THE STUDY

The purpose of this study is to analyse the synergies and tradeoffs that exists between food security and cashew production. Food security studies are very important and this is because

everybody in this world must eat to survive. Good food is the basis for health, and it is said that a country's wealth depends on the health of its citizens and hence making this study very important.

The study seeks to enhance the goal of the study by analyzing the food security status of cashew-producing households by using multiple indicators of food security i.e., availability, utilization, access, and stability to capture how food crops produced by cashew farmers contribute to food security. The conventional view that cash crop competes with food crops production in resources such as land, and labour resulting in food security crisis needs to be analysed. Hence, the result of the study by analyzing the food security from the food crops produced by cashew farmers will unearth if there are food security crises in cashew-producing households. This will reaveal the food security status of cashew farmers and inform policymakers on this regard. It will also lead to the development of the appropriate interventions needed to improve cashew farmer's food security status.

Additionally, there has been little research conducted on cashew production and food security in Ghana. Most research conducted on cashew and food security do not analyse the determinants of food security in cashew-producing households in Bono and Bono East regions of Ghana. Hence, studying the determinants of household food security among cashew farmers is critical. The information derived can be used to take effective actions to promote food security and ensure the success of food security development projects.

The study's analysis on food security pillars and their relationships with cashew production, will enable policymakers have a better understanding on areas to intervene in order to achieve food security or reduce the severity of food insecurity amongst cashew farmers. In addition, the study enables cashew farmers to realize how their food security status is affected as a result of the increase in cashew production. This will inform and enable them to make changes as a result of the proposed recommendations suggested by the study.

Furthermore, the study's findings will contribute to literature since commercial cashew nut farming in Ghana is a relatively new industry that has received little academic attention to date, resulting in a scarcity of knowledge about my research hence the need to undertake this research.

1.5 ORGANIZATION OF STUDY

This research is divided into five (5) major sections. The first Chapter serves as the study's introduction, outlining the study's context, problem statement, research questions, objectives, and justification. The Chapter two highlights a contextual and empirical literature review relevant to the work done. The chapter also reviews the analytical tools and methods used for the various objectives researched by the study.

In addition, Chapter three explains the theoretical and conceptual frameworks on which this study is based, as well as the research methods used in this study, which include a brief explanation of the subject area, sample size determination, data collecting, and methods of analysis of the established objectives. The outcomes of the data analysis from the enumeration are discussed in depth in Chapter four. Finally, in Chapter five, the study's findings are summarized, concluded and recommendations are made based on the findings.

CHAPTER TWO

2.0 LITERATURE REVIEW

Introduction

This chapter provides a review of the study's literature. It reviews other studies that have been conducted on the cashew sector in Ghana, on food security and also the type of statistical and analytical tools employed to assess the objectives as set by this study.

2.1 Food Security Indicators

Food is described as the energy source for humans and therefore limited access to food has a great impact on our health. Food security exists when individuals have economic and physical access to adequate safe and healthy foods that fit their nutritional needs and food preferences for a healthy and active life (World Food Summit, 1996). Food security is determined by six (6) indicators namely: Availability, Accessibility, Utilization Stability, Agency and Sustainability (HLPE, 2020). However, the study focuses on the first four pillars which is Availability, Accessibility, Utilization and Stability. Each of these pillars is important, but they are not enough to assure food security (Barrett, 2010).

Availability

Food availability, according to the FAO, refers to the physical presence of food in the home (FAO, 2006). It also refers to having an adequate or sufficient quantity of high-quality meals. Import and export of commercial foods, food production, home food stocks and food aid are all ways to achieve this at the national level. In relation to the household, this is achieved through household own production or through market purchase. Food availability can be measured using the Months of Adequate Household Provisioning (Swindale and Bilinsky, 2010). A study conducted by Harris-Fry *et al.* (2015) also utilized the months of adequate household food provision to determine the socio-economic household food security and women's dietary diversity in rural Bangladesh.

Accessibility

Food accessibility guarantees that households have sufficient physical and financial means to obtain food in sufficient amounts, quality, and variety to maintain a healthy diet. It also looks at the income of the population, purchasing power, market infrastructure and transport. Accessibility can be measured using the coping strategies index (CSI) (Maxwell and Caldwell, 2008) and the household food insecurity access scale (HFIAS) (Coates *et al.*, 2007). There have been several studies that have looked at the accessibility component of food security such as a study carried out by Ikudayisi *et al.* (2019) on understanding Nigerian urban food security via the lens of accessibility and dietary quality.

Utilization

Food utilization refers to getting enough energy and nutrients while also getting good biological absorption from the food you eat. This is accomplished by a healthy diet, access to clean water, sanitation, and good health care. All these factors ensure the well-being of the individual or household. The utilization dimension of food security can be captured using the household dietary diversity score (HDDS) (Swindale and Bilinsky, 2006). Some studies conducted evaluating the food utilization component of food security include an analysis carried out by Codjoe *et al. (*2016) on food security in Accra, examining urban household factors and dietary variability.

Stability

According to FAO (2006), food stability means that the individual or the household must have access to adequate food at all times. Hence, there should never be a moment when people are unable to obtain food owing to unforeseen circumstances, such as cyclical events such as seasonal food inaccessibility, economic or climate crises (García-Díez *et al.*, 2021). In this way, the term "stability" refers to people's availability and access to safe food supplies. (FAO, 2006; García-Díez *et al.*, 2021). Most of the indicators such as the Coping Strategy Index (CSI),

Household Food Insecurity Scale (HFIAS) and the Months of Adequate House Food Provisioning (MAHFP) which are used to measure availability and accessibility can also be used to assess food stability (Mutea *et al.*, 2019). This is because stability is affected when any of the pillars are affected hence the usage of most of the various indicators to determine stability. For example, when a farmer does not have food available throughout the year stability is affected as per the definition above.

Sustainability

Over time, it has become clear that sustainability is a critical component of food security. (Lang and Barling, 2013). Sustainability is described as the evaluation of a system's strength through time without jeopardizing future generations' ability to meet their own demands. There has been some school of thought to add sustainability as the fifth dimension of food security. Others who see sustainability as the fifth dimension of food security see it as a way to represent and track the capability to ensure all of the dimensions of food security in the long run (UNEP, 2012; Hanson, 2013).

Sustainability takes into consideration sustainable agriculture, economy, food production and sustainable diets (FAO, 2013; Burlingame & Dernini, 2012). Food stability and food sustainability have an element of time however they are not the same. For example, if increased quantities of inorganic agricultural inputs are needed to maintain constant production, In the short term, food will be available at all times; however, this is not sustainable in the long term because the land will become infertile and diminishing returns will set in, causing the land to be unable to produce as much as it should, affecting future generations (Berry *et al.*, 2015).

Agency

Agency looks at the policies and processes that enable the achievement of food security. According to Clapp *et al.* (2021), agency refers to an individual's or a group's ability to exert control over their own situations and offer significant contributions to governance processes.

This aids in addressing broadening discriminations within food systems, such as power imbalances among actors within those systems. A report by UNFSS features the agency as an important part of food security to provide fair living conditions in food systems that are long-term. The report also emphasizes the importance of establishing an agency to address power imbalances and inequity and to reform the systems that support them. (Neufeld *et al.*, 2021,). Table 1 shows a summary of the pillars discussed and some determinant factors that constitute each of the pillars at the national level.

Table 1: Summary of Pillars of Food Security and Determinant Factors at the National level

Pillars	Determinant factors
Availability	• Domestic production • Import capacity • Food stocks • Food aid
Accessibility (physical and economicaccess to food)	• Purchasing power • Income of population • Transport and market infrastructure
Utilization (of food)	• Food safety • Diet quality and diversity (meetingneeds in terms of energy, macro andmicronutrients)
Stability (of food supply and access)	• Weather variability • Price fluctuations • Political factors • Economic factors
Sustainability	• Availability of land • Availability of water • Biodiversity

Source: Adapted from: http://www.unicef.org/albania/Food_Security _ANG.pdf. Accessed 18 December 2015.

2.2 Food Security Situation in the World

Food security is an important developmental issue in the world that every country seeks to resolve. This is the second aim of the Agenda for Sustainable Development, which focuses on achieving food security, reducing hunger, supporting sustainable agriculture and enhancing nutrition.

A country's wealth is dependent on the health of its citizens of which food plays a very important role and hence food security is linked to nutrition security and health. For food security to exist, households need to have unrestricted access to a healthy and nutritious diet. However, according to a report by the Food and Agriculture Organization (FAO, 2019) on the situation of global food security, the number of hungry people has increased over the last three years, reaching over 820 million people in 2018. Also, though there is a lot of food being produced worldwide, these foods and the technology being used in the production do not actually reach those that are in need.

Some factors leading to food insecurity are conflict, climate change, economic slowdowns etc. According to a report by the Food and Agriculture Organization of the United Nations (FAO, 2018) on the monitoring of food security in war-affected countries, the number of people in DR Congo who were food insecure in 2017 increased to almost 2 million as a result of the conflict. A broader look at the food insecurity situation in some parts of the world shows that Asia with a population of 552.9 million people, has the highest number of people who are food insecure (OECD, 2013).

The southern part of Asia of 2018 has the highest food insecurity situation at about 34.3 percent whiles that of Eastern Asia has a percentage less than 10 percent.Africa's food insecurity situation is rising with the eastern part of Africa having the highest percentage of people being food insecure (62.7 percent) and this is followed by the southern part of Africa having 53.6 percent of people being food insecure as of 2018 and this is attributed to factors like adverse

climatic conditions (floods, droughts), economic problems, mismanagement and poor governance, HIV/Aids (Abdalla, 2007). The western and the northern part of Africa come in third and fourth with 47.9 percent and 29.5percent respectively. Latin America and Europe experience some level of food insecurity however these levels are much smaller than the others mentioned above.

2.3 Food Security Situation in Ghana

According to the national budget presented by Attah (2022), roughly 29 percent of the Ghanaian population is into agricultural production. However, because average yields have remained static over time, the country faces the difficulty of making significant progress in food security.

This is a result of food imports and also changes in climatic conditions. A report provided by (MoFA, 2015) shows that a percentage of Ghana's population that is about 1.2 million people are food insecure. According to a report by the World Food Programme in 2009, the Upper West region, which accounts for 34 percent of the country's population, is the most food insecure, followed by the Upper East (15 percent) and the Northern region, which accounts for 10 percent of the country's population. The reason why the northern part of Ghana is food insecure as compared to the south is because, the northern part of Ghana depends on agriculture.

However, most of the cultivation depends heavily on rainfall and therefore when there are prolonged dry periods as a result of lack of rainfall, crop yields are affected leading to low production of food for the household and the market. This situation is minimal in the southern part of Ghana as a result of the two rainy seasons. Therefore, farmers in the south can have food for two seasons while farmers in the North have food for one season.

A recent analysis made by the Food security and Nutrition Monitoring System (FSNMS, 2020) also showed that generally, Ghana is food secure however places like the Bono, Bono east,

Ashanti, Greater Accra and the Northern region were moderately or severely food insecure. This revelation of the Bono and Bono east being moderately food insecure is not surprising as this can be attributed to the gradual substitution of food crop cultivation for an increase in cash crop cultivation especially cashew in the area.

2.4 History of Cashew Production in Ghana

According to Yaro *et al.* (2016), the Dutch were amongst the first to introduce tree crops in Ghana in 1788. The main goal of the tree crop introduction in Ghana was to develop export crops in order to integrate the local or rural economy into the global economy. However, this vision failed due to lack of acceptance by the smallholder farmers in Ghana (Yaro *et al.,* 2016; Awadzi *et al.*, 2001). One of the reasons for the lack of acceptance was due to the long gestation period of tree crops unlike that of the annual crops and also the conflict with the land tenure arrangements due to the gestation period.

Though the tree crops introduced by the Dutch failed, the introduction of cocoa by Tetteh Quarshie in the 1890s widely gained acceptance by smallholder farmers in the forest regions (Ludlow, 2012) under the supervision of the British. The British supported the increase and the widespread use of cocoa through the sale of cocoa tree seedlings. The export of cocoa integrated the country into the global market and this motivated farmers to increase production. By 1957, cocoa had become Ghana's most important source of revenue, accounting for almost 60% of the country's foreign cash (Sowa, 1991). The cocoa sector was also backed by post-colonial governments, who advocated the diversification of export-based crops in order to expand involvement in international trade, which led to the introduction of cashew in the 1960s. However, the introduction of cashew faced some challenges like the lack of market and lack of support from the Ghanaian government (GoG, 2000).

The country resolved in the 1980s to develop and implement initiatives that would permit commodities market deregulation and encourage the production of export crops (Moseley *et*

al., 2015; Yaro *et al.,* 2016). Cashew nut production was introduced as a result of the government's non-traditional commodity diversification policy (GoG, 2000). Ghana shipped 15 metric tons of cashew nuts as part of the strategy, which provided an opening for the export of cashew from Ghana (GoG, 2000). The volume exported climbed to 3,571 metric tonnes by 1997 (GoG, 2000).

Research on the state of Ghana's cashew business was funded by the Ministry of Agriculture in 1998. This focused on the industry's performance, output potential, potential cultivation regions, and general issues impeding its development. One of the study's findings is that the country has the capability to increase the area under cultivation in the, Brong Ahafo, Northern, Upper West and Upper East regions, as well as in the Coastal Savannah, which includes sections of Greater Accra, Volta, and Central regions.

Table 2 shows the projected potential areas for cashew farming in Ghana. The study also unearthed the potential of cashew being a good source of income for farmers leading to poverty alleviation. In view of this, the government took steps to support the introduction of the cashew development project in 2002.

Table 2: Potential Cashew Cultivation Areas in Ghana

Major Production Areas	Potential area (ha)
Greater Accra, Volta and Central (Coastal Savannah)	21,000
Brong Ahafo/Afram plains	1,150,000
Upper East Region	220,000
Northern Region	1,180,000
Upper West region	510,000

Source: SNV (2006/07), as quoted by Addaquay and Nyamekye-Boamah (1998).

Apart from the government support, there has been some support from donor-funded agencies who came on board to support the production of cashew. This includes German Development

Agency (GIZ), Techno serves, the United States Agency for International Development (USAID), and the Adventists Development and Relief Services (ADRA).

As a result of these efforts, Ghana now produces between 110,000 and 130,000 tons of raw cashew (Africa Cashew Alliance, 2021), with over 98 percent shipped to India and Vietnam. The crop has also become one of Ghana's most important non-traditional agricultural exports, with an export value of US$ 378 million in 2018 (Daily Graphic, 2020).

2.5 Policies and Interventions to Increase Cashew Production in Ghana

As previously stated, governments in Ghana have made a number of attempts to support the cashew industry over the last decade. Tree crop policy, cashew development project, planting for export, and rural development are some of the policies developed.

Tree crop policy

The Ministry of Food and Agriculture developed the policy in 2008. It is also the first set of policies adopted by the government to assist in improving the tree crop industry, which is focused on the tree crop value chain. The understanding of the critical role that tree crops play in the Ghanaian economy led to the formulation of this policy. Looking at the success of the cocoa sector as one of the major foreign exchange earners provides proof that if the sector is properly coordinated and managed it can contribute enormously to the growth of the economy. Furthermore, it was discovered that Ghana has a significant comparative advantage over other countries in terms of its ability to produce a large number of tree crops, as well as the potential to generate employment, contribute to poverty reduction, foreign exchange earnings, food security, and GDP growth (MoFA, 2012).

All of the aforementioned elements support the creation of a comprehensive framework for the sub-effective sector's implementation, coordination, and monitoring. Crops that the policy seeks to support include Citrus, Cashew, Cocoa, Coffee, Coconut, Mangoes, Kola, Dawadawa,

Rubber, Shea nut and Oil palm.

The support for the inclusion of tree crops is also based on the principle that poor farmers that are likely to be food insecure are those whose incomes are largely dependent on food crops (MoFA, 2012). As a result, properly integrating tree crops into the farming system to create additional income while not compromising food crop output will be a valuable instrument for improving food security.

However, this is not really the case in most cashew-producing communities. Though there is the championing of the increase of cashew production especially in the Bono and Ahafo regions of Ghana which have seen an increase in the production of cashew, farmers are not properly integrating food crop production in the farming systems. Rather, they are gradually dedicating the majority of their lands to cashew production and leaving little for crop production (Boafo *et al.*, 2019). This however poses a threat to food security.

Cashew Development Project

The cashew development project was instituted by the Ghanaian government and financed by the African development bank (African Cashew Initiative, 2010). The project was developed based on the results of research undertaken by the government to know the development potential of cashew in Ghana. The study unearthed the potential of cashew being a good source of income for farmers leading to poverty alleviation. Based on this, the initiative was designed to raise rural people's living conditions by creating rural jobs, contributing to poverty reduction and earning foreign currency for the country.

The major activities included production, processing, marketing, research & extension, credit provision and local improvements –feeder roads. The Cashew Development Project's goal was to boost cashew output in five areas: the Brong Ahafo, Northern, Volta, Upper West, and Greater Accra regions of Ghana (CDP, 2004).

The project increased the total land area and production in the cashew-growing areas. At the

end of the project, the cashew growing areas had increased its total land area by 24,954 ha and new cashew farms established. This was accomplished by providing improved planting materials or agricultural inputs, making extension services more accessible to farmers, and providing loans for the establishment of new cashew farms. In supporting the marketing sector, the project helped in putting cashew farmers in an association called the Cashew Processors and Exporters Association (CAPEAG). Such projects made the cashew sector attractive encouraging more farmers in the Bono and Ahafo region to go into cashew production. The research sector also received some attention, particularly at institutions like the Cocoa Research Institute of Ghana (CRIG) and the Wenchi Agricultural Research Station, which were tasked with developing improved technologies to strengthen extension delivery, multiplication, and test of improved planting materials for farmers, as well as germplasm conservation (MOFA, 2018).

The project also helped the processing sector by establishing 12 new processing units namely Shop Best, Nsuro Farms, Winker Investments Ltd, Kona Agro Processing, CRIG, Dudasu, Cash Nut Foods Jelana Company Ltd, Latemu, Mim Cashew Products, and NASAKA. Lastly, a total of 192Km of feeder roads was improved in all 10 project districts and also Ghana cashew export earnings increased from US$ 15, 667,500 (31,335MT) in 2003 to US$ 106,000 (70,177MT) in 2009 (CDP, 2009).

Planting for Export and Rural Development

The PERD program was launched in April 2019 by the Ministry of Local Government and Rural Development and the Ministry of Food and Agriculture to improve nine (9) commodity value chains. This includes coffee, cotton, cashew, oil palm, citrus, coconut, shea, rubber and mango, through a decentralized system (Agri house foundation, 2019). Planting for Export and Rural Development (PERD) is a module of the planting for food and jobs program that aims to establish a sustainable raw material foundation to support the One District Factory initiative's

decentralized industrialization drive.

The program is also projected to boost the country's foreign exchange profits by exporting the aforementioned commodities, as well as create jobs. The 5-year PERD program is expected to provide approved free planting materials to one million farmers in 170 districts, covering over one million hectares of farmland.

As part of the project's objective to develop the cashew value chain, the government under the PERD programme is expected to distribute 5 million cashew seedlings to farmers by the end of 2020 (African Cashew Alliance, 2020). The Metropolitan, Municipal, and District Chief Executives will monitor the distribution to guarantee that the seedlings are delivered to the farmers. The programme has begun distributing cashew seedlings to districts such as Ejura Sekyeredumase with about 1,835 cashew farmers being beneficiaries in this district as well as 750 cashew farmers in the Jema district also receiving cashew seedlings under the PERD programme etc. (Farmers Review Africa, 2021).

2.6 Factors Contributing to the Increase in Cashew Production in the Bono and Ahafo Regions.

The Bono and Ahafo regions are known as Ghana's breadbasket because they produce around 30% of the country's primary foods, including yam, cassava, maize, beans, cowpea, and sorghum (Ghana Statistical Service,2013; SRID-MOFA, 2015). Lately, these regions known for their contribution to food crop production are gradually shifting from this narrative into the cultivation of cashew.

According to (Amanor and Pabi, 2007; Amanor, 2009) Cashew production expansion is steadily expanding the region's reach beyond the domestic market and integrating it into the global market. Farmers in the Bono and Ahafo regions are shifting from food crop production to cashew planting due to a number of factors such as:

1. Increased global demand and high income

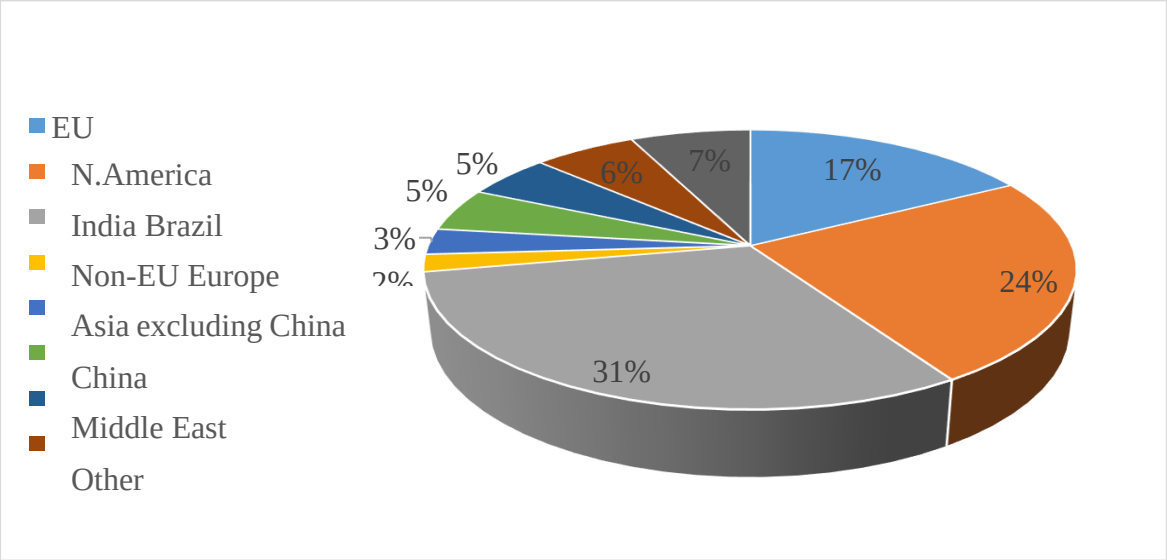
2. Profitability
3. Decrease income from cocoa
4. Worsening climatic and soil condition
5. Cashew farming provides secure land tenure

Increased global demand

According to literature, cashew kernel demand is expanding at a pace of about 7% per year due to its health-promoting features and versatility to be used in a variety of ways (Heinrich, 2012). For example, cashew is used as a snack food, confectionery, and in baking (IFC, 2010). Countries that heavily demand for cashew include India, China, US, Middle Eastern, Western Europe and Brazil. Over 90% of cashew produced in Ghana is exported to India and Vietnam for processing. The processed cashew is also sold to other countries at a higher price.

The enormous demand for cashew became apparent to farmers in the Bono and Ahafo regions due to the presence of Asian cashew nut exporting companies. Their presence is as a result of finding out about the tax imposed on cashew nut exports from Cote d'ivoire whilst cashew nut export from Ghana had no tax (Kone, 2010). As a result, the number of Asian cashew nut exporters in Ghana increased, introducing farmers in the Brong Ahafo Region to the expanding global demand for cashew nuts. Figure 1 below shows the percentage demand of cashew by the international market. The figure below shows that there is a heavy demand for cashew in India, North America and EU.

Figure 1: Cashew Demand by the International Market



Source: UN Comtrade Ingredient Sourcing Solutions, Trade (2009)

Profitability

According to Literature, cashew as a high-value crop can make a significant contribution to their income. The crop is expected to be a moneymaker for farmers as well as an additional export crop that boosts Ghana's present foreign exchange revenues (Ajayi & Place, 2012). Apart from the cashew nut which is the primary by-product, other incomes could be generated from the cashew fruit through the processing of the fruit into cashew gum and apples (Gyedu-Akoto, 2011).

Also, a study conducted by Wongnaa & Vitor (2013) on the profitability of cashew production in the Wenchi municipality shows that cashew production is a profitable business based on positive BCR Value and IRR value obtained. It was discovered that every cedi or US dollar spent in cashew cultivation will yield a return of GH1.13 (US$0.59). They determined that because the benefit-to-cost ratio is greater than one, a cashew plantation may pay for itself and leave farmers with surplus revenue. However, this narrative has to be further explored to see if that is the issue for all the cashew-growing communities in Ghana.

Reduction in Income from Cocoa

According to Mariwah, et al. (2019), farmers in the Bono and Ahafo regions also own cocoa farms in the western region. However, due to the low income obtained from the sale of cocoa beans, these farmers also invest or divert into cashew production. According to the literature, one of the key difficulties affecting farmers in the cocoa value chain is cocoa price. This is due to farmers' lack of bargaining leverage in the price-setting mechanism. These farmers have little bargaining leverage, and price setting has nothing to do with cocoa producers' cost structures (Hütz-Adams *et al.*, 2016).

The price is set lower than the costs involved in the production of cocoa. In addition, low productivity results in the low income generated from the production of cocoa (Odijie, 2016). In order for cocoa farmers to have multiple streams of income, farmers are also going into the cultivation of cashew.

Deteriorating climatic and soil condition

The vulnerability of Ghana's food crop production to climate change is a result of dependence on rainfall and also the depletion of the ozone layer due to the emission of greenhouse gas into the atmosphere. Some of the causes include chemical fertilizer application and biomass burning. Monthly rainfall has decreased by about 2.4 percent per decade since the 1960's (De Pinto *et al.*, 2012).

This can affect food crops through yield reductions, post-harvest losses, and reduced food accessibility and consumption. Another condition that affects food crop production is the gradual depletion of nutrients from the soil causing farmers to use a lot of chemical fertilizer. Unlike crop production, cashew is drought resistant and requires less usage of fertilizer making this cash crop a preferred crop for cultivation in the Bono and Ahafo regions.

Cashew farming provides secure land tenure

Issues of land fragmentation, commercial pressures on land, land invasion and seizing of land by family members, neighboring farmers and influential people in the community have caused farmers to go into cashew production. In addition to cocoa, cashew plantations are regarded as one of the safest ways to protect lands, preventing snatching and encroachment. Cashew production can continue for 20 to 30 years (Catarino *et al.*, 2015), allowing land tenure to be secured over a lengthy period of time. This situation however is not a secure way of solving land tenure problems as this can cause problems for farmers that are not owners of the land.

2.7 Analytical Techniques

This involves a review of some models used in the study such as the Structural equation model and the Tobit regression model.

2.7.1 Structural Equation Model (SEM)

The Structural Equation Model is a path analysis extension that allows for the investigation of relationships between both measurable and latent variables. It uses factor analysis and linear regression to assess the degree to which observed data has been adjusted to a hypothetical model represented by a diagram or mental map (Hair Jr *et al.*, 2016). The linear regression equations in SEM describe how the endogenous construct depends on the exogenous construct. The relationship between the variables is expressed as coefficients called path. In the SEM, rectangles indicate the measured variables (both endogenous and exogenous), while circles represent the disturbance, or error, terms.

By comparing hypothesized associations with latent variables and data obtained by the researcher, the SEM aids in the analysis of complex regression models (Lei &Wu, 2007). Furthermore, SEM aids in the simultaneous analysis of complex regression models and relationships on data gathered from a study. The SEM has been utilized in a number of studies,

including one by Galeana-Pizaa *et al.* (2021) to determine if rural food security is more closely linked to smallholder agriculture than commercial agriculture. With the help of the SEM, the researcher discovered that food availability and accessibility had a greater impact on the modelled food security than food utilization.

The three most prominent types of SEM include the partial least squares structural equation model (PLS-SEM), the covariance-based structural equation modelling (CB-SEM) as well as the variance-based structural equation modelling (VB-SEM).

2.7.2 Tobit Regression Model

The Tobit model is also known as the censored regression model. Tobin (1958) proposed a model in which the dependent variable is considered to have a number of values clustered at a limiting value, usually zero. When censorship is applied to the dependent variable, the preferred model to use is the Tobit regression model. The Tobit regression has been utilized in a number of research. For example, Frimpong & Asuming- Brempong (2013) employed it to investigate the drivers of food security in rural and urban Ashanti households. Bukenya (2017) used it to investigate the factors that contribute to food insecurity in Huntsville. The findings revealed that household income and household size were the most important determinants in predicting household food security status.

2.8 Review of Empirical Studies

Kuma *et al.* (2019) investigated Ethiopian smallholder coffee producers' cash crops and food security. The Household Food Insecurity Access Scale was used to evaluate the food security status of coffee producers in the study area. It was revealed that 40% of respondents were food secure while 60% were food insecure. The impact of several characteristics such as wealth, education, and income on food security reveals that all wealth categories (livestock ownership levels and durable assets, as well as land size) have a negative relationship and are highly

significant, meaning that wealthier households experience less food insecurity. Reduced food insecurity is linked to education whereby families with people who have completed secondary school have lower food insecurity scores, whereas households with higher household income have lower food insecurity scores. Coffee income also helps to alleviate household food insecurity, according to the study.

Rubhara *et al.* (2020) also investigated the impact of cash crop production on smallholder farmers' food security in Zimbabwe's Shamva District. Tobit regression and propensity score matching were used to analyse the factors influencing household food security, and HDDS was utilized to access the food security status. This is consistent with earlier research, which shows that a rise in household income, regardless of source, leads to increased food security in households. The study also found that while arable land had a beneficial impact on household food security while household size had a negative impact. When the size of a household grows, so does the demand for food, and available food may not be enough to meet that demand. Analyzing the relationship between food security and cash crop production it was observed that cash crops positively impacted household food security.

Anderman *et al.* (2014) also investigated the synergies and tradeoffs between cash crops and food security in rural Ghana. Months of adequate household food positioning was used to assess availability, food coping score was used to analyze accessibility, and Child anthropometric measures was used to measure utilization. Multiple regression was run for the three indicators of food security with wealth indicators and household demographics.

The findings of the regression revealed a substantial negative association between food availability and the household's percentage of total land dedicated to cash crops. This means that increasing the size of a farm in order to cultivate cash crops has an impact on food security. It was also observed that the relationship between cash crop intensification and food security was not significant. Farmers, on the other hand, were found to be eating more white tubers and

less vegetables, indicating that increasing levels of cash crop output had resulted in a drop in nutritional quality. The study also shows that cash cropping has a negative association with the three dimensions of food security.

Wongnaa & Ofori (2012) investigated the resource efficiency of cashew producers in Ghana's Wenchi Municipality. In the interviewing of 140 respondents with a structured questionnaire, a basic random sampling procedure was used. For the analysis, descriptive statistics and Ordinary Least squares (OLS) was used. The study discovered that cashew output and inputs (fertilizer, farm size, pesticides and capital) had a positive association, but that labor had a negative relationship. Farmers were also found to be underusing fertilizer, farm size (land), and pesticides, according to the study. On the other side, labor and capital were over-utilized. Bashir *et al.* (2012) also analysed the determinants of food security at crossroads in Pakistan. The study used the binary logistic regression to identify the determinants of food security. According to the study, there is a positive association between food security and income, with a higher monthly income increasing the likelihood of a household being food secure. It was also discovered that the household head's age had a negative impact on the household's food security. Food security and family size have a negative association, according to the study. This implies that an inverse relationship exists between food security and the size of the family.

In the Maphumulo local municipality of South Africa, Ngema *et al.* (2018) investigated household food security and its determinants. The determinants of household food security status were analysed using the Binary Logistic Regression Model. The HDDS proxies as household food security in this study, with households being classed as food secure (given a numeric value1) or food insecure (issued a numeric value 0). The results show that while households may have access to food, they may not be able to meet dietary diversity. Lastly, the results also showed that food security was determined by factors such as, education status, household income, receiving infrastructural support and access to credit.

CHAPTER THREE

3.0 METHODOLOGY

Introduction

The methods used in the study are described in this chapter. It comprises the study's theoretical and conceptual frameworks, important concepts, and techniques of analysis for the various objectives, as well as data collection and sampling methodologies. The geographical aspects of the research area are also described in this chapter. The geographical aspects of the research area are also described in this chapter.

3.1 Theoretical Framework

This section reviews some theories in relation to the study. These theories were selected in line with the study. The usage of income-increasing strategies such as cash crops like cashew is backed by theories such as the Sen Entitlement theory.

Sen's Entitlement Theory

Sen (1981) argues that "People do not usually starve because of an insufficient supply of food at the local, national or international level, but because of insufficient resources such as money ('entitlements') to acquire it. This analogy supports income-increasing strategies such as farmer's adoption of cash crops (cashew) as a means of increasing income. The increased incomes can afford farmers to have access to food. However, there have been several debates on Sen's entitlement theory. Patnaik (1991) and Woldemeskel (1990) argue that Sen ignores the importance of food availability as this will be a grave error to ignore or discount long-term decline in food availability as this can set the stage for famine.

In context, the study, explores sen's entitlement theory by not only concentrating on food crops produced by cashew farmers as a means of cashew farmers attaining food security. The study explores further to analyse Sen's claims by analyzing other factors such as income as a factor for cashew farmer's food security. Sen's entitlement theory has been used in other food security studies involving cash crops. Hashmiu *et al.* (2022) adopted the theory in analyzing cash crops

and food security in Ghana.

Utility Theory

The theory underpinning the study is based on consumer theory and production theory. These theories are mostly used in the decision-making process as seen in the literature by (Shaikh, 2007). These theories were applied in a study by Feleke *et al.* (2005) that looked at the drivers of food security at the household level in Southern Ethiopia.

Following Singh et al. (1986), we assume that for a given production cycle, smallholder cashew farmers maximize their utility functions usually in the short run as expressed in equation (1).

$$U_{cf} = U(Y_{sp}, Y_m, Y_{nm}) \quad (1)$$

Where cf represents cashew farmers, Y_{sp} is the food items from own food production that are consumed. Y_m represents non-food things bought at the market which is consumed, and Y_{nm} is non-food products purchased in the market, such as durables, on-durables, and services etc.

A cashew grower makes multiple decisions concerning food production at the same time i.e., Y_{sp} and the consumption of both food and non-food goods produced by him and purchased from the market. The utility functions are maximized in relation to consumption, production and income constraints (Strauss, 1983).

The **production constraints** are given as:

$$P(Q_{sp}, Qnm, Lb, Ld^0Ft^0, C^0) = 0 \quad (2)$$

Where Q_{sp} is the quantities of own-produced food items, Qnm is the quantities of market nonfood purchased items, and Lb, Ld^0Ft^0, C^0 represent Labour, Fixed Land, Fixed technology andFixed Capital respectively.

Consumption Constraint is given by:

$$P_{sp}(Q_P - Y_P) - P_M Q_M - P_{NM} Q_{NM} - W(L_{On} + L_{Off}) + I_N = 0 \quad (3)$$

P_{sp} are the prices of food items self-produced, $(Q_P - Y_P)$ is the surplus that has been sold, P_M is the prices of food items acquired in the market, Q_M represent the quantity of food items bought in the market, P_{NM} are the prices of non-food items that are bought in the market, W is the wagerate, L_{on}, L_{Off}, I_N represent on-farm labour, off-farm labour and off-farm income, respectively.

Time Constraint: Small farmers are believed to be unable to afford leisure time, thus their total available time (T) is divided into on-farm labor (L_{On}) and off-farm labor (L_{Off}) to maximize utility i.e., T = LR.

$$T = L_{On} + L_{Off} \Longrightarrow Lb \quad (4)$$

Time constraints and consumption can be combined into a single identity by incorporating (4_{cf}) into (3cf) as;

$$P_{sp}(Q_P - Y_P) - P_M Q_M - P_{NM} Q_{NM} - W(T) + I_N = 0 \quad (5)$$

Income constraints are constructed by rearranging the above identity, resulting in the following income constraints; $P_{sp}Y_P + P_M Q_M + P_{NM} Q_{NM} = P_{sp} Q_P + WT + I_N$ (6)

In income constraints (6_{cf}), the consumption expenditures of households are indicated on the left-hand side. For farmer's food (both self-produced and purchased from the market) and non-food products (farm inputs, clothing, health and education costs) purchased from the market. The right-hand sides of these equations, on the other hand, show the income of the households. Farmers make decisions on food production (Y_P) Keeping in mind their intention to consume self-produced food in large numbers (Q_P). The consumer as a household maximizes its utility by equating the marginal rate of substitution between non-food and food products to the marginal product of labor. The excess produced is sold in the

market by the household.

For the production side the input demand D_{In} and output supply Q can be derived as;

$$D_{In} = D (P_{nm}, W, Ft^{0}, Ld^{0}, C^{0}) \quad (7)$$

$$Q = Q (P_P, L_{Off}) \quad (8)$$

The value of income at maximized profits can be calculated by putting consumption and production equations (7 and 8) into the income constraint equation (6) at the optimal level of input and labor selection.

$$Y_F = WL_b + Q (P_P, L_{Off}) + I_N \quad (9)$$

Similarly, in terms of prices, wage rate, and income, the consumer demand might be stated as;

$$Z_F = D (P_M, P_{nm}, W) \quad (10)$$

The utility maximization function for food security is written as:

$$FS_F = F (Y_F (.), Z_F (.) \quad (11)$$

Where F and FS denote the utility maximization function for food security and food security, respectively. The equation (11) shows a simplified phenomenon of rural households' economic behavior for food security in terms of consumption i.e., Y_F related to the availability or food production, income (access) and consumption (utilization) i.e., Z_F related to the food accessibility in terms of resources to obtain the food.

For a combined household food security function, these equations can be represented as a single equation as;

$$FS' = F (Y' (.), Z' (.) \quad (11')$$

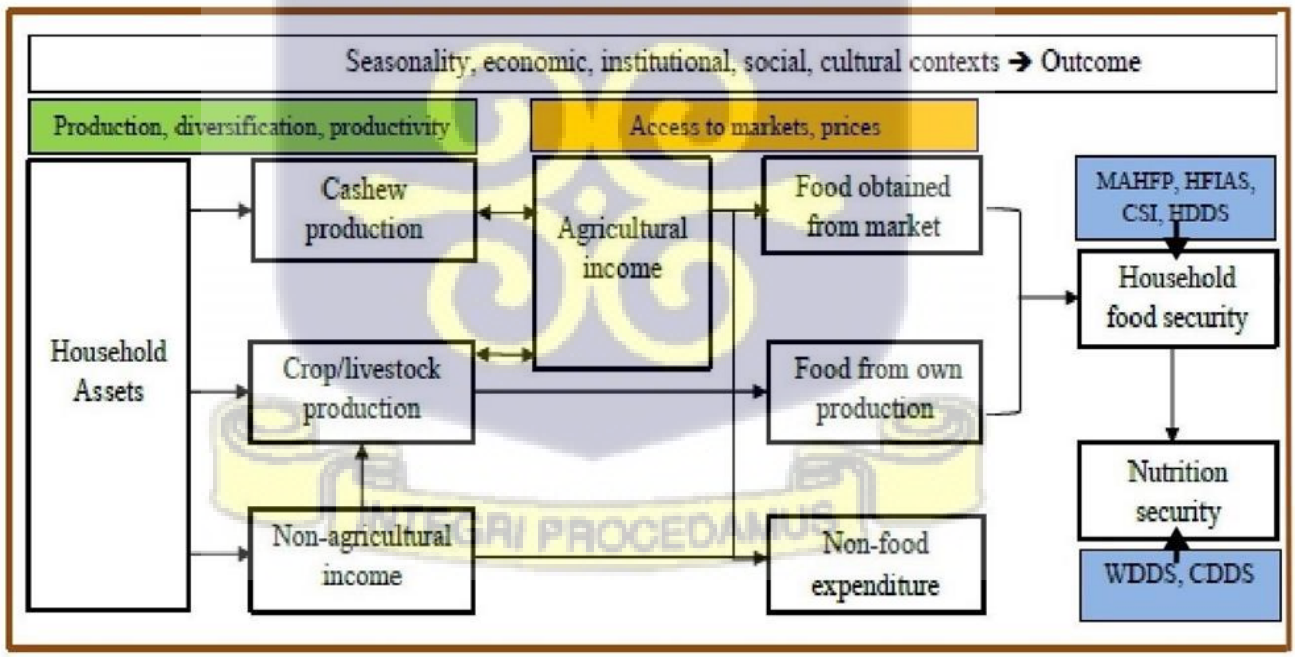
Where; ' stands for the combined household categories

3.1 Conceptual Framework

Figure 2 depicts how a cashew-producing household achieves food security, as well as the factors that contribute to or lead to food and nutrition security. To achieve food security, physical food supplies must be sufficient, households must have adequate access to those food supplies through the market, their own production, or other sources, and individual dietary needs must be met with the right use of those food resources.

The framework depicts household assets such as land, capital, human capital (labour, skills, etc.) as well as the household's livelihood strategy. The quantity of assets that the household possesses will determine if the household will engage in multiple livelihood strategies. This includes cashew farming, food crop production and other livelihood strategies (For example wage income, loan acquisition etc.) this will generate non-agricultural income. We assume that the income generated from cashew production and sale becomes one of the primary determinants of food security for cashew producer

Figure 2: Conceptual Framework



Source: Adapted from WCF (2020)

From the framework, it is expected that the additional money from cashew farming allows the household to acquire food from the local market. This aids in farmer's ability to invest in food crops and engage in crop diversification in order to have diversified diets and improve their nutritional condition. This ensures that the household is food secure. Thus, for the growing of crops and rearing of livestock as well as a diversion into non-agricultural activities generates non-agricultural income. The non-agricultural income is spent on non-food expenditures. It also shows the positive relationship between cashew production and food security whereby cashew can be sold to generate income. In this case, the sale of raw cashew nuts provides agricultural income for cashew farmers which can be used to purchase food from the market and thus food security.

Food availability will be analyzed using selected indicators such as the Month of Adequate Household Food Provisioning (MAHFP). The accessibility component of household food security will be assessed using the Household Food Insecurity Access Scale (HFIAS) and the Coping Strategy Index. The Household Dietary Diversity Score is used to evaluate the dietary diversity of cashew-producing families, while the Women Dietary Diversity Score and Children Dietary Diversity Score are used to measuring the nutrition security of both women and children in cashew-producing homes.

Socio-economic factors (e.g., age, gender, education level of household head, household size, etc.) and services provided by institutions such as education, agricultural extension and health do impact the use of livelihood assets and strategies and household food security. The framework captures the stability pillar as cross-cutting and is represented as vulnerability which refers to the exposure of a household to risks and shocks and the household's inability to manage such risks (WFP, 2009). It is related to food instability over time.

The cashew farmer faces stresses and shocks including insufficient rainfall or drought, pest incidence and disease infestation and conflict. Smallholder farmers who participate more in the

local market tend to be more vulnerable to food price instability. The ability of a household to cope with these shocks and stresses depends on its asset endowment and the portfolio of livelihood and food security strategies being pursued by the household.

3.2 Socio-Demographics of Study Respondents

To explain the socio-demographics of the respondents, descriptive statistics were used to measure household demographics, amount of cashew and food crops produced, expenditure patterns and household incomes. The amount of cashew crop produced by a household is measured as the total quantity of cashew nuts produced (in kilogram) in a year. Likewise, the amount of food crops produced is measured by the total quantity of food crops produced by each household in the year (in kilograms).

A household's agricultural revenue is measured as the total amount of cash income (in cedi value) derived from the sale of cashew crops and non-cashew income. The expenditure pattern was determined by the amount spent on food, education, health, rent, travel and utilities.

3.3 Analyze How Food Crops Produced Contribute to Food Security

The assessment of cashew farmer's food security status will be highlighted under the four pillars of food security instead of six which include agency and sustainability. This is because despite the fact that academic literature emphasizes the relevance of these additional dimensions (agency and sustainability), food security analysis continues to make mention of the four-pillar framework (availability, accessibility, utilization and stability) (Clapp *et al.*, 2021). As a result of the aforementioned, as well as a lack of improved understanding regarding the other two pillars (agency and sustainability), the study focused on the four pillars of food security. Indicators that were used in assessing the four pillars of food security include Months of Adequate Household Food Provisioning, Household Food Insecurity and Access Scale (HFIAS), Coping Strategy Index (CSI), Household dietary diversity score (HDDS), Perception of Seasonality of food items in household and market.

3.3.1 Availability

In measuring availability, the indicator that was adopted was the months of adequate household food provisioning. This is used to measure the number of months during which households were able to provide adequate food from various sources such as own production, stocks, purchases and transfers from neighbours, relatives, government or donors (Bilinsky and Swindale, 2010). The food availability score for months of adequate household provisioning is calculated by delivering a nutrition survey module that asks households to determine the months in which they had inadequate access to food, regardless of where the food comes from (i.e., purchase, production, food aid and or barter). The identification was done with 2 questions; first, whether the household had limited food during the past year. And for those who did, ask for months of limited access.

MAHFP for each household is calculated as:

Twelve months minus the total number of months in the previous year that the household was unable to meet its food requirements. Values for A through L will be either "0" or "1." Note that if the answer to Question 1 was No, then response A-L of question two should be coded as zero (0).

(12) - Sum (A + B + C + D + E + F + G + H + I + J + K + L)

Average MAHFP is calculated as $\frac{\text{Sum } of \text{ the } MAHFPs \text{ for all households in the sample}}{Total \text{ Number of Households}}$

Cordero-Ahiman *et al.* (2018) used this indicator to determine the food access levels of indigenous Mexicans by tallying the months in which a household was not able to supply sufficient food. The results showed that the indigenous Mexicans were not food secure as they didn't have food throughout the year. It also revealed that the indigenes did not have food during December, January, February and March as these months are referred to as the winter months with less food available from the garden.

3.3.2 Accessibility

To measure food accessibility, Household Food Insecurity Access Scale (HFIAS) was adapted to analyse this pillar of food security. HFIAS was used to analyse accessibility because it is considered as a straightforward and valid tool for assessing the accessibility aspect of food security (Gebreyesus *et al.* 2015).

Household Food Insecurity Access Scale detects consumption patterns that households employ in relation to food access. It can provide information on severe responses such as going a day without eating or going to bed hungry (FAO, 2008). The HFIAS as an indicator can also assess the prevalence of household food insecurity (access) over 30 days (4 weeks) recall (Coates *et al.*, 2007). Cashew farmers were assessed based on nine (9) HFIAS occurrence questions asked such as experienced by households in ways such as anxiety over insufficient household food supply, changes to the quality of food and reduction to the quantity of food intake (FAO, 2008; Coates et al., 2007). The responses are then summarized into a score for each household, with the score minimum score of 0 and maximum score for a household is 27 (i.e., the household response to all nine frequency of occurrence "1 = no or never)'', "2= rarely or sometimes "3 = often"). A higher score implies that households have less access to food and, as a result, are more likely to be food insecure. The mean score will be estimated for the household as its aggregate hunger scale.

$$\text{Average HFIAS Score} = \frac{Sum\ of\ HFIAS\ Scores\ in\ the\ sample}{Number\ of\ HFIAS\ Scores\ in\ the\ sample}$$

In a study conducted by Yahaya (2018), this indicator was utilized to measure the food security (access) status of farmers who employed sustainable farming methods. The HFIAS score generated a lower score of 2.98 indicating that farmers who used sustainable agricultural practices were food secure than those who did not use sustainable agricultural practices.

In order to compare the level of access, households were classified into terciles based on the

computed HFIAS scores for the two regions combined: most food secure terciles equal scores of 0-11; medium food secure equal scores of 12-16 and least food secure equal scores of 17 or more.

3.3.3 Reduced Coping Strategies Index

Coping methods are short-term reactions to crises on livelihood systems in the face of unpleasant conditions (Berkes & Jolly 2002). They can also be thought of as temporary reactions to limit the effects of undesirable situations in which food access is disrupted abnormally by earthquakes, drought, military activity or floods (ACF, 2010).

Previous research on small-scale farmers' coping techniques has found that these strategies differ between households and throughout time, depending on choices, aims, opportunities, and restrictions (Eriksen *et al.*, 2005). The reduced CSI has also been mentioned as one of the indicators of food access (Renzaho and Mellor 2010). A series of questions were administered to capture people's basic consumption-related coping reactions to inadequate access to food as well as not having enough money to buy food in order to analyze utilizing this indicator. Two more pieces of information were collected in order to run such an analysis and produce CSI results. The first is a method for assessing relative frequency, whereas the second is a method for scoring the weights that were calculated. The frequency is a measurement of how many days in the previous week a family had to utilize various coping mechanisms —ranging from "never" (0) to "every day" (7). In other to be able to score the weights, universal coping strategy questions from literature were asked and the severity was assessed during the Focus Group Discussions (FGD) to ascertain which strategies are mostly used by the cashew farmers and also to find which coping strategy was considered to be severe or not severe.

To understand the coping strategies used by farmers in the Bono and Bono East Region. The severity level was determined by asking members of the community to classify the coping mechanisms they utilized based on their personal experiences. (1 = less severe, 2 = moderate,

3 = severe, and 4 = very severe).

The final CSI score is calculated by multiplying each frequency by their corresponding weights and then summing up the total for each copying strategy. The index generates a score ranging from 0 to 56 where lower rCSI show high food security status while higher rCSI show low food security status. Ziaei *et al.* (2013) used this indicator to examine food security and coping mechanisms in Gorgan's rural districts. The index's result revealed that 17.60 percent of total households were classed as food secure, while the remaining homes that used any of the coping techniques were classified as having some degree of food insecurity.

3.3.4 Utilization

The study analysed the dietary diversity of women, children and the household using the women dietary diversity score, child dietary diversity score and household dietary diversity score (HDDS). HDDS was used to measure utilization amongst cashew farmers because it is also able to illustrate the quantity of different types of food or food groups that individuals consume and how often they consume these food groups (Coates *et al.*, 2007).

Dietary diversity at the household level reflects the economic access to a diversity of food by the household and as well a proxy indicator of nutrient adequacy at the individual level. To compute the HDDS, respondents were asked to remember local foods eaten by any member of the household over a 24-hour period. This was calculated as the total number of different food groups (roots and tubers, cereals, fruits, vegetables, meat/poultry/offal/eggs/fish/seafoods, legumes/pulses/nuts, milk and milk products, oils/fats) ingested by the family during a 24-hour period (FANTA, 2007). The HDDS is generated by counting the food groups consumed by any household member from the total of 12 groups; so, the score ranges from 0 to 12 (FAO, 2007). The larger the number, the more diverse the food consumed. The maximum score is the number of food groups of interest. In the analysis a total of 16 food groups were used since some of the food groups were expanded.

$$\text{(Average HDDS)} = \frac{\text{Sum HDDS}}{\text{Total } Number\ of\ Households}$$

During the COVID-19 pandemic in Bangladesh, Kundu et al. (2021) employed this measure to investigate the factors of family food security and dietary diversity. During COVID-19, many Bangladeshi homes had a low dietary diversity, according to the study while majority consumed more starchy staples as compared to the other food groups.

3.3.5 Women Dietary Diversity Score (WDDS)

In assessing the nutritional status of women in the project area, the women dietary diversity score (WDDS) was used. WDDS was used to capture the average number of various food groups consumed by reproductive aged women (15 - 49 years) in the previous day or night. The women were graded on nine different dietary groups, including grains, roots, tubers, and plantains, as well as nuts and seeds, dairy products (meat, poultry and fish), eggs, vegetables with dark green leaves (other vitamin- A rich fruits and vegetables), other fruits and vegetables, this is in line with the guidelines proposed by (FAO, 2011). The score range for the WDDS is between (0-9) where high scores are preferred as they show high dietary diversity as compared to low scores. WDDS is divided into three categories i.e., those with high dietary diversity, medium dietary diversity and lowest dietary diversity. Women who consume less than or equal to 3 food groups are considered as having the lowest dietary diversity. Medium dietary diversity includes women who consume 4 and 5 food groups while those who are considered as having the highest dietary diversity consume more than 6 foods.

3.3.6 Child Dietary Diversity Score (CDDS)

The study used child dietary diversity to analyze the nutritional status of children. The food items used to generate the diet diversity indicator are included in the dataset used in the analysis. The survey inquired about the foods consumed by children during the previous day. Based on the WHO's Infant and Young Child Feeding Guidelines, we divided these foods into

seven primary food groups (FANTA, 2006). These food groups are: (i); legumes and nuts; (ii) grains, roots, and tubers (iii) flesh foods (meat, fish, poultry and liver/organ meats); (iv) eggs; (v) vitamin A-rich fruits and vegetables; (vi) other fruits and vegetables (vii) dairy products (milk, yoghurt, cheese). If a child consumed at least one food item from a food group during the previous day, the group was given a value of one (1) for that child, and zero (0) if the child did not consume any food from that group.

3.4.6 Stability

Stability was analysed by using farmer's perception of the seasonality of food items in the household and market as a result of changes in market prices, drought, crop failure, pandemic and fire. A series of questions were asked such as "in the past year have there been times when there was reduced amount of food available due to market prices''. Farmers used a 5-point Likert scale to respond to questions asked. The responses include strongly agree, agree, neutral, disagree and strongly disagree.

3.5. Analyze the Determinants of Food Security and Strategies Developed by Farmers to Reduce Vulnerability of Food Insecurity.

In analyzing the determinants of food security, the Tobit regression analysis was used to determine which factors affect the farmer's food security and quantify their effect. Because the dependent variable is censored from the left or right, the Tobit regression model was used to estimate linear correlations between the independent and dependent variables. The Principal Component Analysis (PCA) was first used to confirm the variable that loaded well under each of the indicators i.e., availability, accessibility, utilization and stability. Afterwards, an index was generated from the variables which were used as the dependent variable and as a substitution for household food security. The explanatory variables included gender, age, educational level, marital status, household expenditure, income, household size, access to market, distance to market, region and refrigerator. These explanatory variables were used to identify the factors that affect availability, accessibility, utilization and stability. The dependent

variables were truncated based on the scores generated by the individual food security dimensions to remove respondents considered as food insecure.

The reason for using the Tobit regression is because of the continuous but truncated character of the dependent variable. For HDDS (minimum = 0, maximum = 16), HFIAS (minimum =0, maximum = 27) and MAHFP (minimum=0, maximum=12).

Also, as mentioned above, the ordinary least squares regression method fails to evaluate the qualitative difference between zero and continuous observations since the dependent variable is restricted between specified values.

The Tobit model is given as: $Y_t = X_t + \varepsilon$

- Y_t = Food security (Availability, Accessibility, Utilization and Stability)
- X_t = gender, age, educational level, marital status, household expenditure, income,household size, access to market, distance to market, region and refrigerator
- ε = Error term

Strategies to reduce vulnerability will be obtained from the literature and confirmed with households in focus group discussions and through individual interviews

3.6 Examine the Food Security Pillars and their Relationship with Cashew Production.

To analyse this objective, the Structural Equation Model (SEM) was used. SEM is a multivariate analysis approach for examining relationships between latent components and measurable variables. The SEM approach allows simultaneous analysis of complex relationships between the dependent outcome (e.g., food security) and independent variables. Under this task, the SEM technique will capture Food Security as a latent variable. This is considered a dependent variable and regressed on the determinants of the four dimensions of food security (availability, accessibility, utilization and stability) in relation to cashew

production. The directions of the significant estimates in the model will reveal the tradeoffs and synergies between cashew production and the dimensions of food security.

Model Specification

The Structural equation model is specified as follows using the linear structural relations formulation (Bollen, 1989).

$$\eta = \beta\eta + \gamma\xi + \varepsilon \quad (1)$$

$$X = \Lambda x\, \eta + c \quad (2)$$

$$Y = \Lambda y\, \xi + \delta \quad (3)$$

Equation 1 shows the variable latent model whereby η represents the endogenous construct, ξ represents the latent exogenous construct and Ɛ is the latent error for i =1, 2…N observations. β is a matrix that shows the effect of the endogenous construct on each other while γ is a matrix that shows the effect of the exogenous construct on the endogenous constructs.

Equations 2 and 3 show the relationship that occurs between the unobserved variable and the observed variables. The observed variables (Y and X) are signs of the latent endogenous η vectors and the latent exogenous ξ. The Λx and Λy are loadings of endogenous and exogenous indicators, respectively, representing the regression coefficients relating Y to ξ and X to η respectively. The vectors c and δ are measurement errors.

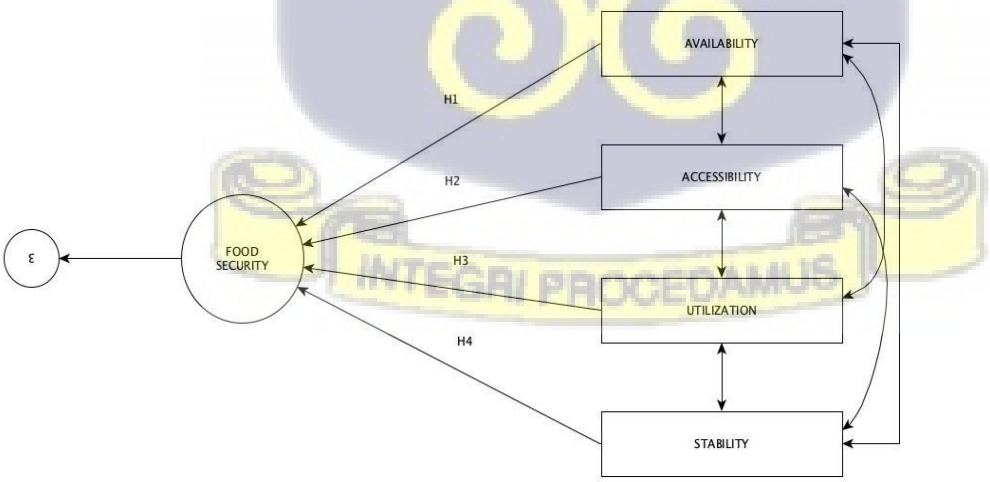


Figure 3: SEM Framework for the Study

Figure 3 depicts a simple SEM path diagram showing how the various pillars contribute to food security as well as the linkages that exist between the various components of food security. The operationalization stands to answer the following hypothesis:

Hypothesis 1: The availability dimension does not affect food security.

Hypothesis 2: The accessibility dimension does not affect food security.

Hypothesis 3: Utilization dimension has no effect on food security. Hypothesis 4: Stability has no effect on food security.

Other hypothesis of interest includes:

Hypothesis v: No bi-directional relationship between Availability and Accessibility on household food security.

Hypothesis vi: No bi-directional impact of Availability and Utilization dimension on household food security.

Hypothesis vii: No bi-directional impact of Availability and Stability dimension on household food security.

Hypothesis vii: No bi-directional impact of Accessibility and Utilization on household food security.

Hypothesis viii: No bi-directional impact of Accessibility and Stability dimension on household food security.

Hypothesis ix: No bi-directional impact Utilization and Stability dimension on household food security.

However, the analysis of the SEM begins by first conducting a factor analysis to reduce the items under each construct (Food Accessibility, Food Availability, Food Utilization and Food Stability). Secondly, a reliability test was conducted to establish the normality and the sampling adequacy of the data. Lastly, Structural Equation Model was then fitted to ascertain the relationships between household food security and cashew production.

3.7 Method of Data Analysis

The information gathered was examined quantitatively and qualitatively, and the results were combined during the report writing process in accordance with data mixing standards. The quantitative data were captured electronically using Kobo collect and transferred into Microsoft excel for the data to be cleaned and analyzed using STATA. Interviews and focus group discussions constituted qualitative information, which was transcribed.

The study employed the STATA14 statistical package in the analysis of the primary data collected from the respondents. Data collected was analyzed using descriptive statistics; quantitative variables are summarized by means and standard deviation and the results are presented using tables and figures.

The synergies and trade-offs between cashew production and food security were analyzed using the structural equation modelling (SEM). A factor analysis was utilized to evaluate the variables employed in the study's key constructs. A reliability test was performed to establish the internal consistency of the data using the Cronbach Alpha computation for the study constructs.

3.8 Sample Size and Data Collection

A multistage sampling technique was employed whereby purposive and random sampling was the main technique used for the study. The two regions and districts were purposely sampled due to the fact that these regions produce the majority of Ghana's cashew. To get respondents from cashew-growing areas, a simple random sample method was used. The total sample size for the study was 240. 130 respondents were randomly selected from the Bono East Region and 110 respondents from the Bono region. Data was collected from two regions and six (6) districts. Bono East (Techiman North, Techiman south, Nkoranza south) and Bono region (Sunyani West, Tain and Wenchi). The community list from the two regions was obtained from the Cashew Industry Association of Ghana (CIAG).

A pilot test was conducted prior to data collection to ensure that the questions and expected responses by the rural cashew-farming households were reliable and appropriate. Following the discovery of mistakes during the pilot survey, the questionnaire was revised. Some data collected includes production, sales and incomes, assets, expenditure, and food consumption and its diversity at the household level; livelihood strategies. The survey was used to collect household demographic variables including headship of household by gender (measured as a percentage), and education status of household head (measured as the number of years spent by the household head to acquire formal education).

3.9 Study Design and Area

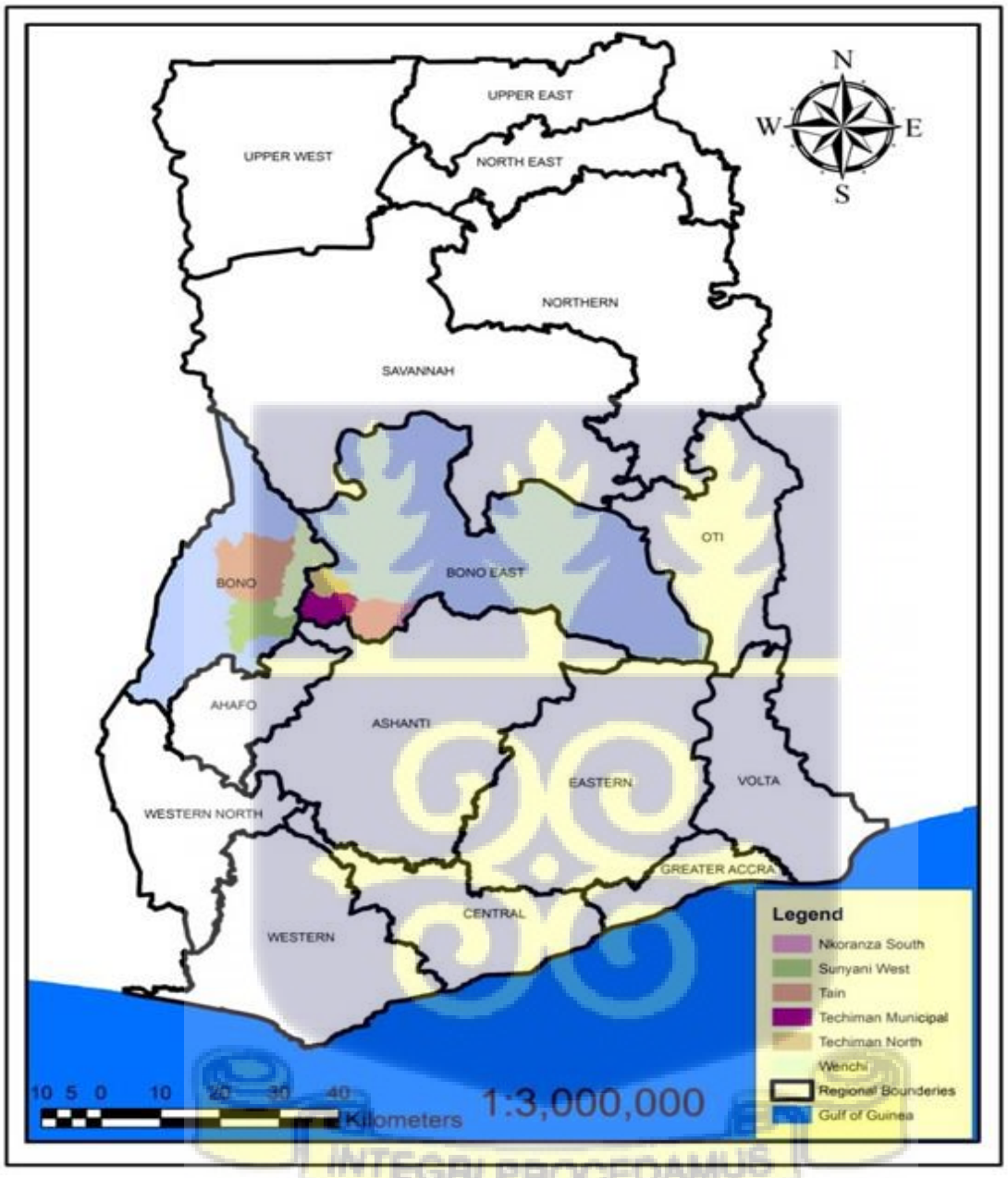
The study used a convergent parallel mixed methods strategy to collect quantitative and qualitative data at the same time (Creswell, 2014). The quantitative data was gathered from cashew growers using a well-structured questionnaire, while the qualitative data was gathered through focus group discussions (FDG). The decision to use mixed methods was based on the belief that a social phenomenon like food security necessitated a combination of quantitative and qualitative approaches in order to gain a better knowledge of the subject.

The study was conducted in the Bono and Bono East Regions of Ghana. The Bono and Bono East regions are part of the 16 regions of Ghana which were recently carved out of the Brong Ahafo region. The study is focused on these regions because they are considered major cashew-producing in the country. The increase in the production of cashew in this area is a result of increased incomes obtained from the sale of raw cashew nuts as well as the boost by the government to increase cashew production as a result of high foreign exchange earnings.

The Bono region shares a northern boundary with the Savannah Region, and is bordered on the west by the international border of Cote d'Ivoire, on the east by Bono East, and on the south by the Ahafo Region. Major crops grown are maize, cashew nut, cassava, plantain, and cocoyam, tomatoes etc. The Bono East Region covers a total land area of 39,557km2 and it is bounded

on the north by the Northern Region, on the west by the Bono Region, on the south by the Ashanti Region, and on the east by the Volta Lake. Major crops that are grown include cocoa, cashew nut, mango, yam, cocoyam, cassava, plantain.

Figure 4: Map of Study Area



Source: University of Ghana Geography department

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

Introduction

This section presents results and discussions of findings. The chapter opens with a description of socio-economic characteristics of cashew farmers. This is followed by the results of the analysis of how food crops produced by cashew farmers contribute to food security based on the four pillars of food security. Results showing the determinant of food security and coping strategies adopted by cashew farmers are discussed. The estimated structural equation model showing the tradeoffs and the synergies that exist between cashew production and food security is also discussed.

4.1 Socio-Demographics of Cashew farmers

4.1.1 Gender of Household Head

The gender distribution of the household heads for the cashew farmers considered in the study shows that, a majority (75 percent) of the cashew-producing households in the study are headed by males. This is illustrated in Table 3. This may be due to the fact that land ownership has an impact on the ability to produce cash crops, and because women frequently have less access to resources, particularly land (Meinzen-Dick *et al.*, 2010), their involvement in the production of cash crops is low in comparison to men.

Wongnaa & Ofori (2012) conducted a study on resource-use efficiency in cashew production in Wenchi Municipality and the study revealed similar results of male dominance in cashew farming. This could also be attributed to the assertion that females are unable to cope with the physically demanding tasks necessary in cashew farming.

Table 3: Demographics of Sampled Respondents

Characteristics	Grouping	Frequency	Percentage
Gender	Male	180	75
	Female	60	25
Education	No Education	57	23.75
	Basic /Middle Education	141	58.75
	SHS/Voc	29	12.08
	Tertiary	13	5.42
Marital Status	Single	16	6.67
	Married	192	80
	Widower/Widow	18	7.50
	Divorced	14	5.83

Source: Own Survey data, 2021

4.1.2 Educational Level of Household Heads

The educational levels of the heads of the cashew-producing households in the sample are presented in Table 3. The results show that 58.57 percent of household heads have Basic or Middle or Junior High School education. Furthermore, 23.75 percent of the household heads have no formal education. This is in line with the findings of a study conducted by Armah (2018) revealed that the majority of cashew farmers have basic or middle or junior high school education. Though farmers have a basic level of education, a higher literacy enables farmers to take better decisions with efficient ways of lessening the cost of production in order to decrease losses (Martey *et al.*, 2012).

4.1.3 Marital Status of Household Heads

The results from the study revealed that about 80.0 percent of the household heads are married, 7.5 percent are widows or widowers, and 6.7 percent are single whilst only about 5.8 percent of cashew farmers are divorced. This is represented in table 3. This result is quite similar to a study conducted by Ngema *et al.* (2018) on household food security status and its determinants in Maphumulo local municipality, South Africa. The study also revealed that the majority of her respondents were married. This could be due to the husband and wife's capacity to combine

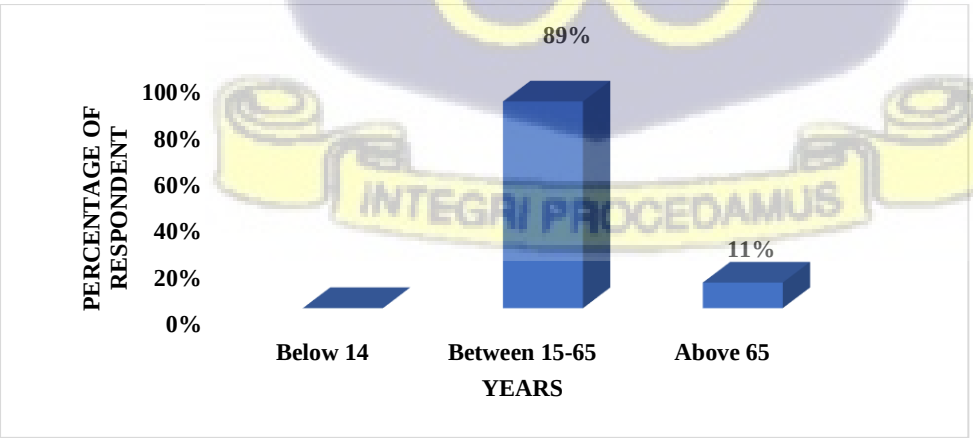
their resources in order to boost production. For example, during the focus group discussions, it was revealed that most wives of cashew male farmers assist their husbands in their operations such as fetching water for the men during the application of agrochemicals. Also, some wives due to inheritance possess lands and therefore by nature of marriage both husbands and wives combine their resources to increase the production of cashew.

4.1.4 Age of Household Head

The study shows that a relatively higher percentage (89 percent) of cashew farmers can be found in the working-age population. This is between 15-64 years while 11 percent of respondents are elderly or in the dependency group which is from 65 years and above. This categorization was also used by Anderman *et al.* (2014).

The mean age group of the household heads is 50 years old. This is similar to the results of Onyemauwa *et al.* (2013) who had a mean age of 53. The minimum age is 24 years and the maximum year is 84years old. The mean age group for cashew production could be explained by the reason that when farmers reach age 50 years old and above, they are unable to actively participate in the preparation of land for annual crop production each year, and therefore they choose to cultivate tree crops such as cashew. This will allow them to have a steady annual income during their retirement (Armah, 2018).

Figure 5: Age categorization



Source: Own survey data, 2021

4.1.5 Household Size

The mean household size is 5.95 which constitutes approximately six (6) people in a household. The minimum household size is one (1) while the maximum household size is twenty (20). This can be observed in Table 4. According to GSS (2019), the national average household size in the rural area is 4.4. This means that the average household size of cashew farmers in the study area is higher than the national average household size in rural areas. Large household size negatively affects food security (availability, utilization) whereby limited food resources will have to be shared amongst a large number of people.

Table 4: Household Size

Variable	Mean	Std.dev	Min	Max
Household size	5.95	3.178	1	20

Source: Own Survey data, 2021

4.1.6 Agriculture Production: Crop and Livestock

Apart from cashew, households who diversify into crop and livestock production enhance their food security status as it serves as a source of food as well as income to attain food security. Food crop produced enhances the suggested four pillars of food security (availability, accessibility, utilization and stability). Hence, the need to analyse the amount of food crops produced and livestock owned.

4.1.6.1 Average Output of Food Crops Produced by Cashew farmers

Table 5 presents the average quantities of the various food groups harvested by cashew-growing households in the Bono and Bono East Region. According to the study, the average quantity of maize harvested by cashew farmers in the Bono East region is 1821.61 Kg/ha, while the amount harvested by the Bono region is 1083.55 Kg/ha, however the national average maize output in 2020 was 2563 Kg/ha (SRID, 2020). When the national average of maize produced is compared to the amount of maize produced by cashew farmers in both regions, it

is clear that the national average is higher than the quantity being produced by cashew farmers in the study area.

Furthermore, Table 5 shows that the Bono East region harvests around 4451.71 Kg/ha and 5495.40 Kg/ha of roots and tubers like cassava and yam respectively, whereas the Bono region harvests about 4586.18 Kg/ha and 5803.87 Kg/ha of roots and tubers like cassava and yam. In 2020, the national average production of cassava and yam was 22663 Kg/ha and 16595Kg/ha respectively (SRID, 2020). When the average national yield is compared to the average yield produced by cashew farmers, it can be seen that the farmers' yields of yam and cassava are lower than the national average.

Lastly, the Bono East region harvests 1802.44 Kg/ha and 4027.78 Kg/ha of vegetables (pepper and tomatoes) respectively, while the Bono region harvests 687.14 Kg/ha and 1060.14 Kg/ha of vegetables (pepper and tomatoes) respectively. The national average yields for pepper and tomato are 6998 Kg/ha and 7499 Kg/ha, respectively (SRID, 2020). When the national average production of tomatoes and peppers is compared to the average yield of cashew farmers, it is clear that the farmers' average yield is low. From the above, it is obvious that cashew farmers produce fewer food crops than the national average, which is worrying because low food availability can contribute to household food insecurity.

Table 5: Average Output of Food Crop Produced by Cashew Farmers

Crops	BonoEast Region	Std. dev	Bono Region	Std. dev
Maize (Kg/ha)	1821.61	2652.33	1083.55	833.73
Cassava (Kg/ha)	4451.71	3642.17	4586.18	2759.63
Yam (Kg/ha)	5495.40	8257.38	5803.87	4733.01
Plantain (Kg/ha)	2213.95	2981.44	2282.14	1367.07
Pepper (Kg/ha)	1802.44	1540.78	687.14	694.44
Tomato (Kg/ha)	4027.78	2827.58	1060.14	530.33
Other Crops (Kg/ha)	1379.17	1322.44	697.92	483.18

Source: Own Survey data, 2021

4.1.6.2 Average Quantity of Animals Owned by Households.

The study also analyzed the average quantities of livestock owned by cashew-producing households. According to Tefera (2014) livestock contributes to food security by providing both financial and nutritional benefits. The results from Table 6 show that the average cattle owned by cashew farmers in Bono and Bono East Regions is 3 and 2 respectively while the national average of cattle owned by households is 11 (GSS, 2019). Based on this, it can be observed that the quantity of cattle reared by cashew farmers in the study area as compared to the national average is low. This result is similar to Taylor (2017) who discovered that cocoa-producing households owned the fewest number of cattle. This could be due to a variety of causes, including the high cost of purchasing cattle and the difficulty of rearing cattle (Taylor, 2017).

The result also showed that majority of households in Bono and Bono East Regions owned poultry, sheep and goat. The average quantity of poultry owned by households in the Bono and Bono East regions are 44 and 33 respectively while the average quantity of sheep owned by the Bono and Bono East region are 22 and 12 respectively. Lastly, the average quantity of goats owned by households in the Bono and Bono East region is 8 and 11 respectively. These results are corroborated by Evans *et al.* (2014) who also found out that several people interviewed in the study area also had small livestock, such as goats, sheep and poultry which are sold during financial difficulties and occasionally consumed.

Table 6: Average Quantity of Livestock Owned by Households

	Bono	Std.dev	Bono East	Std.dev
Cattle	3	1	2	1
Sheep	22	7	12	4
Goat	8	7	11	9
Poultry	44	12	33	15
Others	17	8	0	-

Source: Own Survey data, 2021

4.1.6.3 Average Cashew Yield

The average quantities of cashew harvested are presented in Table 8. The average quantity of cashew produced by male-headed and female-headed households is about 1433 Kg and 629Kg respectively. The average cashew yield in the study is 0.82t/ha. According to MoFA (2018), the national average yield of cashew was about 0.44t/ha. From the study, it can be observed that there's been an increase in the yield of cashew though it's still lower than the estimated potential yield of 1.8t/ha determined by the Ministry of Food and Agriculture (MoFA, 2018). This could be attributed to the governments support over the years.

According to Monteiro *et al.* (2017) the increase in production is attributed to the increase to land expansion committed to cashew cultivation rather than increased output per hectare. This could explain the low yield obtained from food crops obtained by cashew farmers in the study as farmers are dedicating more of their lands to cashew production than food crops hence the increase in the production of cashew and the reduction of food crops. It has also been observed that the average yield of cashew obtained by male-headed cashew farmers is higher than that of female-headed cashew farmers. This could be attributed to the fact that female households do not have the energy to produce cashew on a large scale as compared to male-headed households. Also, female-headed household do not have enough financial support to purchase inputs such as agrochemicals to increase production hence low yield.

Table 7: Average Cashew Yield

	Male-headed households	Std.dev	Female-headed households	Std.dev
Cashew (Kg)	1433	2030.50	629	818.11

Own Survey data, 2021

4.1.7 Household Income

The total household income was calculated using cashew income and non-cashew income. The

non-cashew income comprises income generated from the sale of food crops, other cash crops apart from cashew, animals, income generated from petty trading, transport business, salaried/pension, gift or remittance and income from artisan. The result showed that the average income generated from cashew per annum is GHS 5,732.36 and the average non-cashew income per annum is GHS 4,778.84. The average total household income per annum is GHS 10,107.39.

The national average income of households living in the rural area is GHS 5,880 (GSS, 2019). In comparing the household income of cashew farmers in the study area with the national average income of households living in rural areas, it can be observed that the cashew farmers have high incomes. This is about twice the amount of income made by households living in the rural area as a result of the sale of raw cashew nuts Furthermore, based on the revelation that majority of cashew farmers' income is generated from the sale of cashew nuts, a reduction in the price of cashew will greatly impact household income. This can lead to cashew farmers experiencing food insecurity.

Table 8: Average Income of Households

	Mean	Std. dev
Cashew Income (GHS)	5732.36	4505.09
Non-Cashew income (GHS)	4778.84	3094.78
Total income (GHS)	10,107.39	9953.44

Source: Own survey data, 2021

4.1.8 Expenditure Pattern

Table 9 presents the share distribution of household expenditure among various household socioeconomic needs such as food, education, health, rent, travel and utilities. It can be found from the results that cashew farmers spend the majority of their income on education. This constitutes about 56 percent of their annual household expenditure. This is quite contrary to

results found by Rubhara *et al*. (2020) who found that majority of farmer's expenditure is spent on food. Also, according to Browne *et al.* (2007) households in low-income areas, food expenditure is the highest expenditure category whereas cashew farmers do not show low income hence that could explain the use of the majority of income on education instead of food expenditure.

Furthermore, the second item that most farmers spend their income on is food and this constitutes about 18 percent share of per capita average annual expenditure. This is quite contrary to the results of the GSS (2019) that revealed that farmers in the Bono and Bono East spend 49.7 percent of their income on food.

However, this does not rule out the fact that farmers in these regions spend a significant portion of their income on food even though they spend a majority of their income on education. The report from GSS (2019) further revealed that these regions have the highest expenditure on food as compared to the other regions. This is could be as a result of the dependence of cashew farmers on the market as a result of low production of food crops which is not able to cover households for the entire 12 months as illustrated in Table 10. Travels and funerals constitute about 7.14 percent and 6.47 percent share of per capita average annual household expenditure respectively, whilst utilities (such as Electricity, and water), health and rent constitute about 5.89 percent, 4.07 percent and 2.10 percent share of per capita average annual household expenditure respectively.

Health and rent constitute the least household expenditure because most farmers interviewed live in their own homes and do not pay rent. In addition, due to the national health scheme provided by the government, most farmers do not spend a lot of money when they visit the hospital for treatment. From the study, despite the fact that cashew farmers spend the majority of their income on education, the second highest expenditure was on food. This indicates that while cashew farmers produce food crops, the quantity is insufficient, resulting in reliance on

the market during certain months of the year

Table 9: Household Expenditure Pattern

	Mean	Std. Dev.	Share of HH Exp (percent)
Food	309.50	257.76	18.22
Education	952.93	868.09	56.10
Health	69.16	121.95	4.07
Rent	35.67	26.11	2.10
Travel	121.32	120.81	7.14
Funerals	109.98	117.39	6.47
Utilities (Electricity, Water, etc.)	99.96	92.85	5.89
Total Household Expenditure	1698.55	1558.17	100

Source: Own survey data, 2021

4.2 Contribution of Food Crops Produced by Cashew Farmers to Food Security

4.2.1 Food Availability (MAHFP)

This objective was measured using the Months of Adequate Household Food Provisioning (MAHFP). The MAHFP score ranges from 0-12. The lower the score the higher the food insecurity status. A mean score of 9.75 was calculated indicating that on average household cashew farmers experienced about 10 months of adequate food supply annually out of 12 months (Table 10). Comparing across regions, it was observed that both regions had food available for about 10 months out of the 12 months. However, the value for the Bono region was higher than that of the Bono East region. Table 10 shows that the Bono region has more cashew farmers who had more food available than the Bono East region. This is confirmed from Table 5 whereby Bono region produces more of the starchy staples such as cassava, plantain, and yam which are highly consumed staples in the country.

Furthermore, during FDG it was revealed that though the farmers grow cashew, most of the lands are not dedicated solely to cashew production, however, some portions of the lands are also dedicated to food crop production. The reason for food availability in the two regions.

However, though there is food available, there are also some months when cashew farmers did not have enough food to meet the needs of the family and this could be terrible for the household leading to severe hunger during this period. This result is consistent with a study conducted by the World Cocoa Foundation (2020) whereby cocoa farmers had food available for 10 months of the year.

The lack of sufficient food during the entire year could also explain the reason why cashew farmers spend a significant portion of their income on food as indicated in Table 9 as the food produced is not enough to last them throughout the year. In addition, this outcome also reveals the seasonal food gaps that occur when cash crop-producing households deplete their subsistence food supply and/or food stocks. During the FGDs, participants reported that they rely on the cultivation of subsistence crops such as cassava, plantain, yam, maize and tomatoes for home consumption.

However, over reliance on cashew production, and limited attention to staple crops offered limited opportunities for households to produce adequate quantities of staple foods needed for home consumption.

Table 10: (Months of Adequate Household Food Provisioning) by Region

Indicators	Mean	Std. dev	Sample size
Combined MAHFP	9.75	1.48	240
Bono	9.85	1.38	110
Bono East	9.64	1.61	130

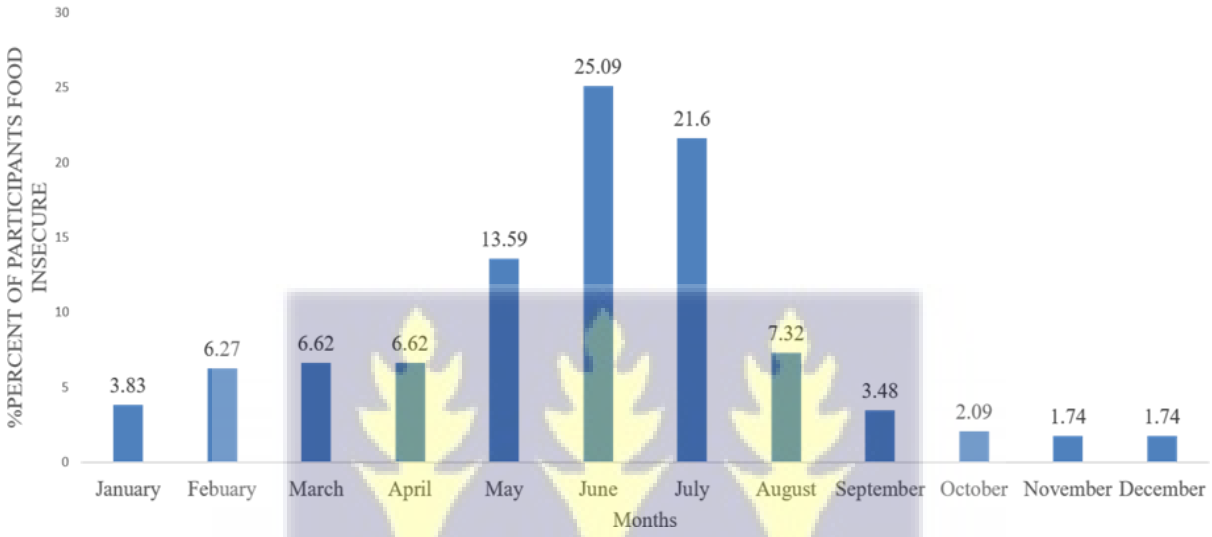
Source: Own survey data, 2021

A further study to find out the months in which cashew farmers did not have enough food available showed that a majority did not have food available from May to July. This is shown in Figure 6. This is because these months are considered the 'lean period' where most farmers face challenges (WCF, 2020).

Cashew farmers at the FGD recounted that during this period, the cashew season would have

been over resulting in a low amount of income during this period. Also, crops such as maize are yet to be harvested; plantain and other crops are yet to mature. This assertion is backed by a report from WCF, (2020) and Mariwah *et al.* (2019) that revealed that most cashew farmers usually between May and July have finished their food supplies and are waiting for the new crops to mature.

Figure 6: Months of Household Food Insecurity



Source: Own survey data, 2021

4.2.2 Food Accessibility

From Table 11, it can be observed that the overall households in the study area appeared to have access to food with a mean score of 2.96 out of 27. As indicated in the methodology that lower scores are preferred to show that cashew farmers have access to food. In light of this, the study reveals that cashew farmers have resources (income) to purchase food from the market as shown in Table 9 that cashew farmers spend a significant portion of their income to purchase food from the market when they do not have enough food available (own food production). This corroborates the report from GSS (2019) that the highest percentage of total expenditure on food is in the Bono and Bono East regions. From Table 11, it can also be observed that households in the Bono region with a lower mean score of 2.84 were more food secured than those in the Bono East region.

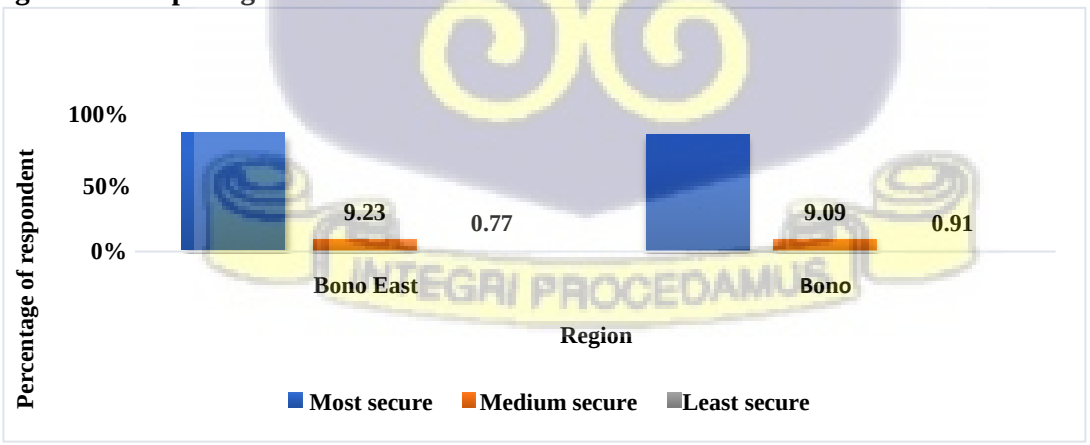
Table 11: Comparing Household Food Insecurity and Access Scale (HFIAS)

Indicators	Mean	Std. Dev.	Sample size
Combined Household Food Insecurity Access Scale	2.96	2.80	240
Bono	2.81	2.69	110
Bono East	3.06	2.93	130

Source: Own Survey data, 2021

Comparing the levels of food access using HFIAS across regions, the study revealed that the majority of the households across both regions, accounting for about 90 percent, were found to have access to food. Although most farmers had access to food there are about 10 percent of farmers who had challenges in getting access to food which could lead to vulnerability to food insecurity. Therefore, it is recommended that a cost-effective intervention to address food insecurity should target the food insecure households. The high food security status can be explained by the fact that accessibility is determined by both physical access (market) and economic access (purchasing power). According to Ahmed *et al.* (2017), one of the most critical variables affecting rural food security could be market accessibility. In the Bono and Bono East regions, most farmers have access to markets where they can purchase food when their own food produced gets finished.

Figure 7: Comparing Levels of Access



Source: Own Survey data, 2021

4.2.3 Food Utilization

Table 12 shows a mean HDDS score of 8.86 which indicates that households consumed about 8 to 9 food groups out of the 12 on a weekly basis signifying high dietary diversity. All regions had high dietary diversity scores but higher for the Bono region with farmers consuming about 9 to 10 food groups as compared to cashew farmers in the Bono East region who consume about 7 to 8 food groups out of the 12 food groups analyzed. The high household dietary diversity could be partly explained by households' growing of crops such as maize, starchy staples (cassava, plantain, and cocoyam) and vegetables for home consumption.

Table 12: Comparing Household Dietary Diversity (HDDS) by Regions

Indicator	Mean	Std. Dev	Sample size
Combined Household Dietary Diversity Score	8.86	2.98	240
Bono	9.96	3.29	110
Bono East	7.87	2.20	130

Source: Own Survey data, 2021

4.2.4 Food Variety

A total of sixteen (16) food groups were included in the computation of household dietary diversity. In an effort to understand the varieties of food consumed, an analysis and comparison of consumption patterns derived from the dietary diversity tool were performed (Table 13). There was high consumption of starchy foods with about 90 percent and 84 percent of households consuming food items from roots & tubers, plantain and cereal groups, respectively. This was expected because households extensively produce root and tuber crops (mainly cassava, yam and plantain) and cereals mainly maize for household consumption. These are often used to prepare main local foods like Fufu (prepared from a combination of cassava, and plantain), Banku (prepared using dough made from maize and cassava) and Ampesi (cooked yam, plantain, sometimes cassava). This is confirmed by a report from the FAO (2009) that the Ghanaian diet largely relies on starchy roots (cassava, yams), fruit

(plantain) and cereals (maize, rice).

A large proportion of households, 90 percent, consumed vegetables other than dark green leafy and vitamin A rich vegetables. The most consumed in this food group were tomato, onion and garden eggs which were also widely used to prepare soups and stews. Fish is the main source of animal protein for households and was consumed by about 85 percent of respondents. This could also be because most livestock produced are sold rather than consumed as indicated by Evans *et al.* (2014). Food items mainly pepper and salt were consumed by 84 percent of households from the spices, condiments and beverages group. The high consumption of tomato, onion, garden eggs, pepper, fish, salt and oils was not surprising because they are mostly used in the preparation of various soups and sauces to complement the main local foods like Fufu, Banku and Ampesi.

The main food items consumed by 83 percent of households from the fats and oils group were red palm oil and cooking oil which were used for frying purposes at home. Households (66 percent) consumed dark green leafy vegetables mainly nkontomire since they are available naturally. Dark green leafy vegetables or nkontomire are rich sources of vitamin A and vitamin C (FAO, 2011). Night blindness and cognitive impairment are the most common symptoms of vitamin A insufficiency, which affects children under the age of five and pregnant women. (IFPRI, 2014; WHO, 2010).

Vitamin A therefore, prevents night blindness and helps in cognitive development. Organ meat was only eaten in small amounts among households, with only 5 percent of the households reported to have consumed this food group. Organ meat (e.g., liver, kidney, heart) is an excellent source of haem iron, which is more bioavailable than non-haem iron and is considered to enhance the absorption of non-haem iron. Organ meat diet is therefore recommended for the prevention of anaemia (FAO, 2011). These results are quite similar to studies conducted by Nti (2008) in the Manya krobo districts. The results show that the majority of households consume

starchy staples, cereals, fish as their main source of protein, fruits and vegetables such as pepper, tomato, and onion because they are mainly in soups and stews

Table 13: Distribution of Household Heads Based on Consumption of 16 Food Groups

Food groups	Percent of households (n=240)
Roots and tubers + plantain	89.8
Other vegetables	89.6
Fish and seafood	84.6
Spices, condiments and beverages	84.0
Cereals	83.8
Fats and oils	82.9
Dark green leafy vegetables	65.6
Sweets	32.5
Flesh meat	25.6
Legumes, nuts and seeds	24.1
Vitamin A rich vegetables	21.9
Other fruits	20.8
Eggs	16.2
Vitamin A rich fruits	10.2
Milk and milk products	8.0
Organ meat	5.2

Source: Own survey data, 2021

4.2.5 Assessing the Nutritional Status of Women (15-49)

Based on the analysis the mean dietary diversity for the households is 4.79 and this means that on average, women in the Bono and Bono East regions consumed about 5 food groups out of the 9 food groups assessed. Figure 8 presents the distribution of the sampled information by Women Dietary Diversity Score (WDDS). The results show that 16 percent of women (15- 49 years) consumed more than 6 food groups and hence had high dietary diversity. In addition, 59 percent of the women consumed 4-5 food groups and are therefore said to have medium diversity, while 25 percent had low dietary diversity because they consumed up to 3 food groups. The mean WDDS was 5, indicating medium dietary diversity among the women. The results show a generally limited dietary diversity among the sampled women. The food groups included in the WDDS, according to FAO (2011), better reflect micronutrient consumption than economic access to food. Therefore, the regular consumption of diets covering only

limited food groups may translate into stunting, wasting, underweight or undernutrition among women (Chagomoka *et al.*, 2015).

An analysis and comparison derived from the women's dietary diversity were carried out to understand consumption patterns (Table 14). Out of the 9 food groups included in the WDDS, about 99 percent of the women were found to consume food items from the cereals and starchy staples group. The high consumption of starchy foods could be explained by the high production of food crops in this group, such as maize, cassava, yam and plantain in the study areas.

Furthermore, 94 percent of the women consumed other fruit and vegetables, this is because for other vegetables, this contains the most consumed are tomato, onion, garden egg and pepper, the main ingredients of soups and sauces. Also, 82 percent of the women obtained animal protein from the meat and fish group. Smoked fish forms are the main source of animal protein for women but also frozen chicken is consumed. Also, 63 percent of the women consumed dark green leafy vegetables and the most consumed dark green leafy vegetable is nkontomire (cocoyam leaves). About 55 percent of the sampled women consumed items from nuts and seeds which mostly consists of food with nuts such as agushie and groundnut soup made out of nuts. 46 percent of women consume vitamin A-rich fruit/vegetables. Eggs, milk and milk products, and organ meat had low percentage values of 41 percent, 19.25 percent, and 5.3 percent respectively.

These results are similar to that of Cisse-Egbuonye *et al.* (2017) who used WDDS to determine nutritional adequacy and dietary diversity among women in Niger. The study also found that the majority (98.4 percent) of women consume starchy staples with the least food groups consume being eggs, dairy and organ meat.

Table 14: Distribution of Sample by Dietary and Consumption of 9 Food Groups

	Variable/Item	Percent (n=213)
Women dietary diversity	Low diversity score (WDDS ≤ 3)	25
	Medium diversity (WDDS = 4-5)	59
	High diversity score (WDDS ≥ 6)	16
Food groups	Starchy staples	99.0
	Other fruits and vegetables	94.3
	Meat and fish	82.1
	Dark green leafy vegetables	63.2
	Legumes, nuts and seeds	55.4
	Vitamin A rich fruits and vegetables	46.0
	Eggs	41.0
	Milk and milk products	19.3
	Organ meat	5.3

Source: Own Survey data, 2021

4.2.6 Child care and Nutritional Status (6-23 months)

The result of CDDS produces a mean score of 2. This means that children in cashew growing areas on average consume 2 food groups out of the 7 food groups evaluated. The most commonly consumed types of foods were grains, roots and tubers (97 percent), flesh food containing meat and fish (69 percent), other vegetables (59 percent) legumes and nuts (52 percent), vitamin A-rich fruits and vegetables (50 percent). Food items from the remaining food groups, such as eggs, were ingested by a smaller proportion of children (45 percent), milk and dairy products (19.61 percent).

Table 15 shows that children in cashew growing areas consume starchier staples than the protein, fruits and vegetable food groups. This ratio is not good for children who are in the development phase. Khamis *et al.* (2019) discovered that eating animal-source foods helps to prevent stunting and being underweight. It was also discovered that animal-source foods like meat, milk, eggs, and chicken include a number of micronutrients like vitamin A, vitamin B-12, riboflavin, calcium, iron, and zinc, which are difficult to receive in sufficient amounts from plant-based diets. As a result of the aforementioned, a child's physical development may be hampered by a lack of essential nutrients, leading to stunting.

Table 15: Distribution of Sample by Dietary and Consumption of 7 Food Groups

	Variable/Item	Percent(n=102)
Food groups	Starchy staples	99.0
	Flesh foods	69.0
	Other Vegetables	59.0
	Legumes and nuts	52.0
	Vitamin A rich fruits and vegetables	50.0
	Eggs	45.0
	Milk and milk products	19.61

Source: Own survey data, 2021

4.2.7 Stability

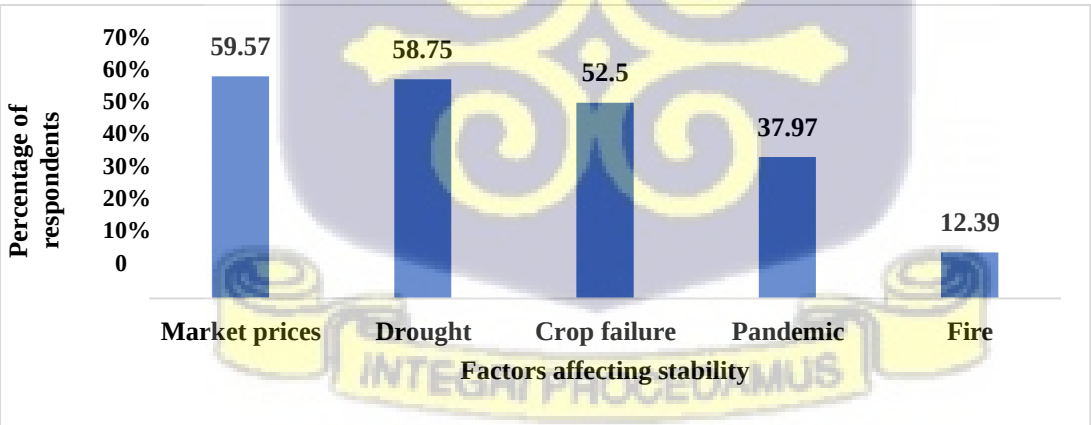
According to a report (FAO, 2006) stability is ensured when population, household or individual farmers have access at all times. Therefore, smallholder farmers were assessed on some factors that affect stable availability and access to food at all times. The factors include crop failure, drought, and changes in market prices, Covid 19 and fire outbreaks. According to Welderufael (2014), rural households' vulnerability to food insecurity is likely to grow as a result of shocks such as disease, drought, and crop failure.

The results showed that most farmers (59.57 percent) are affected by changes in market prices. This is because even though cashew farmers use part of their land portion for food crop production, the majority of their lands are being used for cashew, and therefore not a lot of food is being produced for home consumption. This leads the farmers to depend on the market for food during the lean season and also purchase other items such as meat, fish, and salt from the market. Therefore, when there is an increase in the prices of these commodities on the market farmers are unable to purchase the same quantity as they would have preferred, thus food availability and access are affected. Drought was also a factor that affects farmer's inability to have food available throughout the year. This is corroborated by a statement made by Abbam (2018) that Ghana's climate has gotten drier and more prone to drought conditions during crop-growing seasons over the previous century. This is as a result of the high

dependence of farmers on rainfall and the low adoption of irrigation systems in the country (MoFA, 2015). During the FGD farmers acknowledged the role that climate change plays as one of the factors that cause drought. Smallholder farmers who planted early expecting rainfall during the major rainy season were disappointed. About 52.5 percent of farmers expressed that crop failure was also a problem for them. This is attributed to pest infestation for example some farmers who grew maize during the FGDs recounted how their crops were destroyed to fall armyworms The resurgence of the fall armyworm on maize in some districts in Ahafo, Ashanti, Bono, Bono East, Central, Eastern, Greater Accra and Western regions was announced by MoFA (2020).

The study also showed that 37.97 percent of farmers recounted that Covid 19 affected their ability to access food, especially during the period when the country was under lockdown. They also explained that prices of food increased during the period, which resulted in the low purchase of food items on the market. Prices of cashew on the market during the period were low leading to low incomes. Since most cash crops depend on high income to attain food security, they felt the impact.

Figure 8: Factors Influencing Cashew Farmer's Food Stability



Source: Own Survey data, 2021

4.3The Determinants of Food Security

In the Tobit model, the sign of the coefficient indicates the direction of influence of the

independent variable on the dependent variable. As a result, a positive coefficient shows an increase in either the MAHFP, HFIAS, or HDDS score, implying a higher risk of a household being food insecure, whereas a negative coefficient suggests a lower likelihood of a home being food secure.

4.3.1 MAHFP

Analysis of the independent variable on food security using MAHFP can be observed in Table 16. The result shows that gender was not significant. This is in line with a study conducted by Leah (2013) on determinants of household food access among small farmers in the Andes. The results also proved that there was no statistical relationship between gender and MAHFP. However, age was significant ($p < 0.10$) and negatively related to food availability. From the results, a unit increase in age will lead to a 0.001 decrease in the food available to households. This means that as the farmer grows old, he or she will not have enough strength to grow more food as well as go to the farm as frequently as compared to a young farmer and therefore, he/she would not be able to have enough food available at home throughout the year.

This result is corroborated by Babatunde *et al.* (2007) who shared the same view that the age of the household head has an influence on his or her labour supply for food production whereby younger household heads would be able to cultivate large portions of land as compared to older household heads. In addition, there is high demand for the cultivation of tree crops by the older generation and thereby limiting the amount of food crops being produced. This was highlighted by Evans *et al.* (2015) that older farmers are interested in growing more cashew crops as this tree crop is seen as a form of inheritance which can be passed onto the younger generation. The results from Table 16 show that basic/middle and SHS/Tech/vocational levels of education were not statistically significant however a further analysis revealed that tertiary level of education is statistically significant ($p<0.10$) and it is positively related to food availability. This means that a unit increase in higher level of education (tertiary) will result in a 0.069

increase in food availability. This means that the higher the education level of the household head, the more food secure the household. This is because literate people are often driven by a desire to learn and a willingness to accept agricultural or livestock extension services. This increases their production and thereby increasing their own food production and also income to be able to access food when there is a food shortage. This finding agrees with Valešová *et al.* (2017), who investigated the relationship between food insecurity and socioeconomic features of rural households in Western Indonesia. According to the study, homes led by people with higher educational degrees had better food provisioning. Specifically, people with master's degrees have a higher MAHFP than those who do not.

The marital status of a household head was significant ($p < 0.05$) and positively related to food availability. This means that a unit increase in the marital status of household heads will lead to a 0.035 increase in food availability, implying that households headed by married individuals are able to pull their resources in getting more food crops for the household and therefore they have a lower chance of becoming food insecure. This is quite opposite to results found by Osman (2015) who was of the view that single households are more food secure than married households because they do not have a lot of mouths to feed as compared to married households. Hence, the amount of food available is higher for single households than that for married households.

Household expenditure is highly significant ($p<0.01$) and negatively related to food availability. This means that a unit increase in household expenditure will lead to a 0.033 decrease in food availability. This could be attributed to farmer's preference for spending their income on non-food items (e.g., education) rather than on food items. This therefore, decreases their food security. Income and household size are not statically significant. Access to markets is statistically significant ($p<0.01$) and positively related to food availability. This shows that a unit increase in market access by farmers will result in a 0.043 increase in food availability,

implying that the availability of a market source enables farmers to get food when they do not have food available in their households and thereby reducing food insecurity. Variables such as distance to the market and having a refrigerator are statistically not significant. Region has an influence on food security, Region is statistically significant ($p<0.01$) and negatively related. This means that farmers in the Bono region are more secure as compared to those in the Bono East region. This is a result of farmers in the Bono region being the largest producers of food crops such as yams, cassava, plantain and maize. These food groups are majorly consumed in most households and the availability in most households signifies months of adequate household provisioning.

4.3.2 HFIAS

Using the HFIAS score as a proxy for food security, the results showed that gender is statistically significant ($p<0.10$) and is negatively related to food accessibility. This means that households headed by females are more food secure compared with male-headed households. This is because females normally go to the market to purchase food for the household as compared to males.

The coefficient for education, measured by the level of education shows that the basic level of education is not significant however higher level of education such as shs/voc or tertiary level of education is statistically significant ($p < 0.05$) and positively related to household food accessibility. This means that a unit increase in shs/voc and tertiary level of education will lead to a 0.903 and a 1.254 increase in food accessibility respectively. This implies that the higher the education level of the household head, the more food-secure the household. This result is similar to (Mota, 2019) shows that educational level reduces household food insecurity and increases food security. Marital status is statistically significant ($p < 0.05$) and positively related to food accessibility implying that married households have higher food access than single households. This could be attributed to the fact that in a married household there is a woman

present to ensure that when there is no food available in the house, food is sourced from the market to take care of the household. This is quite contrary to Aidoo *et al.* (2013) who found that there is a negative relationship between marital status and food security. According to the author, households headed by married people have larger households and thus more mouths to feed hence even though food is sourced from the market it is not enough to feed the household. Household expenditure is highly significant ($p<0.01$) and negatively related to food accessibility. This means that a unit increase in household expenditure will lead to a 0.867 decrease in food accessibility. This could be a result of farmer's demand for nonfood items and thereby increasing their nonfood expenditure in comparison to food. This is seen from the results in Table 9 that farmers spend more of their income on education than food and this can lead to an increase in food insecurity in the household.

Household income is statistically significant ($p<0.01$) and positively related to food accessibility. The result shows that a cedi increase in income will result in a 0.585 increase in food accessibility. This implies that as income increases the more farmers are able to have the purchasing power to demand or obtain food from the market. This result is similar to that of Mwangi *et al.* (2020) who analysed the household food security and food value chains in North West Mt. Kenya. The study suggested that households with higher incomes were less likely to be food insecure. Household size was statistically not significant. Farmers' ability to access the market is very important hence it's being significant ($p<0.01$). It is positively related to food accessibility. This means that a unit increase in market accessibility will result in a 1.733 increase in food accessibility. This implies that as farmers are able to access the market, their food security level increases. Farmers who own a refrigerator are able to increase their food accessibility. This is because the results show that this factor is significant ($p <0.10$) and is positively related to food accessibility. It means that when farmers own a refrigerator, they are able to store excess produce or even reduce the amount of post-harvest harvest loss that occurs.

Table 16: The Determinants of Food Security

Variable	Months of Adequate household food provisioning	Household food insecurity access scale	Household dietary diversity	Stability
Gender	0.032	-1.048*	0.134	-0.097**
Age	-0.001*	-0.003	-0.047***	-0.001
Education level				
Basic/Middle	.02844	-0.877	1.427***	-0.389
SHS/Tech/Voc	-.02572	0.903**	1.201**	0.0023
Tertiary	0.069*	1.254**	1.767**	0.184**
Marital status	0.035**	0.751*	-0.157	-0.03401
Household expenditure	-0.033***	-0.867***	-0.812***	0.0497**
Income	0.010	0.585**	0.108	0.0416**
Household size	(0.004)	0.453	-0.494*	-0.105***
Access to market	0.0431***	1.733***	-1.323	0.009
Distance to market	-0.0002	.01762	-0.007***	0.001
Refrigerator	0.018	0.893*	0.930*	0.0462
Region	-0.042***	0.294	-1.742***	-0.033
_cons	1.0064	4.434	15.62802	0.675

*** p<0.01, ** p<0.05, * p<0.1 Source: own survey data, 2022

4.3.3 HDDS

In analyzing the determinants, it was realized that gender was not significant this is consistent with literature by Usman & Callo-Concha, (2021) who also found out that the effects of household head's sex on HDDS were found to be statistically non-significant.

However, age is statistically significant ($p<0.01$) and it's negatively related to food utilization. This means that an increase in age will lead to a 0.003 decline in food utilization. This implies that as farmers age their preference for certain food groups decline and therefore it decreases their food security level.

Education is statistically significant and positively related to food utilization. This shows that a unit increase in tertiary level of education will result in a 1.767 increase in food utilization. This means that as the level of education increases, farmers get enlightened and are able to demand quality food in comparison to those that have a low level of education. This is in line with Rashid *et al.* (2011) and Woldehanna and Behrman (2013). Both researchers found that as the educational level rises, so does the demand for nutritional variety.

Marital status is not significant however household size is statistically significant ($p<0.10$) and negatively related to food utilization. This implies that a unit increase in household size will lead to a 0.494 decrease in food utilization. This is because an increase in household size causes the family food demand to also increase. This affects or reduces the amount or the quantity of food that the household can consume due to limited food. This result is in conformity with the findings from Welderufael (2014). This finding is also consistent with theoretical and empirical evidence (Teshome; 2010, Frehiwot; 2007). Shiferaw *et al*. (2003) also revealed that it also exerts more pressure on consumption than it contributes to production.

Household expenditure is statistically significant ($p<0.01$) and negatively related to food utilization. As mentioned earlier farmers do not prefer to spend the majority of their income on food components when food from their own stocks gets depleted. This contributes to a decline

in their food utilization as they do not pay much attention to what they eat. The distance to market, as measured by the time was also found to have a negative and significant relationship with food utilization, implying that the farther a family is from the market, the less likelihood of the farmer receiving information about market pricing which can affect food utilization. This is because when a farmer should go to the market during periods when prices of food are high, the quantity of food that would be purchased is likely to be low affecting the quality of food consumed.

The coefficient of having a refrigerator is positively related to food utilization and is also statistically significant ($p<0.10$). This means that the possession of a refrigerator enables the farmers to have access to food and thereby increasing the amount of diverse food consumed as compared to when the farmer does not have a refrigerator.

The regions have an influence on a farmer's food utilization status. The results show that farmers in the Bono region have a high dietary diversity as compared to those in the Bono East region. As indicated, the Bono region is considered the largest producer of major food groups consumed in most households. This includes crops such as plantain, cassava, yam, vegetable and maize. This presents a wide array of food groups to be consumed by farmers. Therefore, the possibility of farmers in the Bono region having a higher dietary diversity than farmers in the Bono East region.

4.3.4 Stability

The result for stability shows that the coefficient of gender is negative and it is statistically significant ($p<0.01$). This shows that female-headed households are able to reduce their level of instability throughout the year as compared to male-headed households. Higher levels of education such as tertiary level of education are positively related to food stability and it is statistically significant ($p<0.01$). This means that a unit increase in education will lead to a 0.184 increase in food stability. This shows that an increase in the level of education increases

food stability. This is because most educated farmers have other sources of income (Mzyece *et al.*, 2021) and therefore they are able to have higher incomes which can be used to access food when their own food produced is not enough. They are also able to put into practice what has been taught by extension officers to increase production.

Household expenditure is positively related to food stability. This means that as farmers spend on food items their level of food security increases (Babatunde *et al.*, 2019). Income is positively related to food stability and significant ($p<0.01$). This reveals that income can be used to purchase food during periods when there is a shortage of food. Even though farmers do not spend a majority of their income on food items, during periods when there is a shortage of food from their own production, they are able to augment this by getting food from the market.

4.4 Coping Strategies Used by Farmers to Reduce Cashew Farmer's Vulnerability to Food Insecurity

The study went further to analyse the coping strategies adopted by cashew farmers when they didn't have enough food available, especially during the lean period as confirmed in Figure 6. It was revealed that some of the coping strategies used by the cashew farmers include eating less preferred or expensive foods, borrowing food from friends or family, limiting portion sizes, restricting consumption by adults so that children can eat and reduction in the number of meals eaten in a day. This finding supports the conclusion made by Birara *et al.* (2015) and Woldeamanuel (2009), that when a food crisis strikes, rural households adopt a variety of coping methods to lower the danger of food insecurity. The coping strategies mentioned above were also adopted by Saaka (2017) to analyse coping strategies adopted by pregnant women in rural areas of Northern Ghana.

A breakdown of the findings to find out the most used coping strategy and the least used method can be found in Fig (9). The results reveal that majority of cashew farmers resort to eating less expensive and preferred food. This is in line with a study conducted by Mukhtar (2019) on

Food insecurity and coping strategies among rural households in Niger state. The result revealed that the majority of respondents resorted to eating less preferred food. During the focus group discussion, a farmer cited that *"the food I like best is fufu and goat light soup, however when I don't have money, I end up eating oil rice because it's less expensive''*.

The next coping mechanism used by the farmers is limiting portion sizes. A farmer gave an example during the focus group discussion *"First we could consume two cups of rice however, due to how expensive things have become, during times when there is no money and shortage of food, we cook just one cup of rice in order for the bag of rice to last for a longer period of time"*.

Another strategy used is the reduction in the number of times eaten in a day. Another farmer in the Wenchi district during the FGD also said that *"We eat twice in a day i.e., in the morning when we are going to the farm and then in the evening when we return from the farm. We cannot afford to eat three times in a day.''*

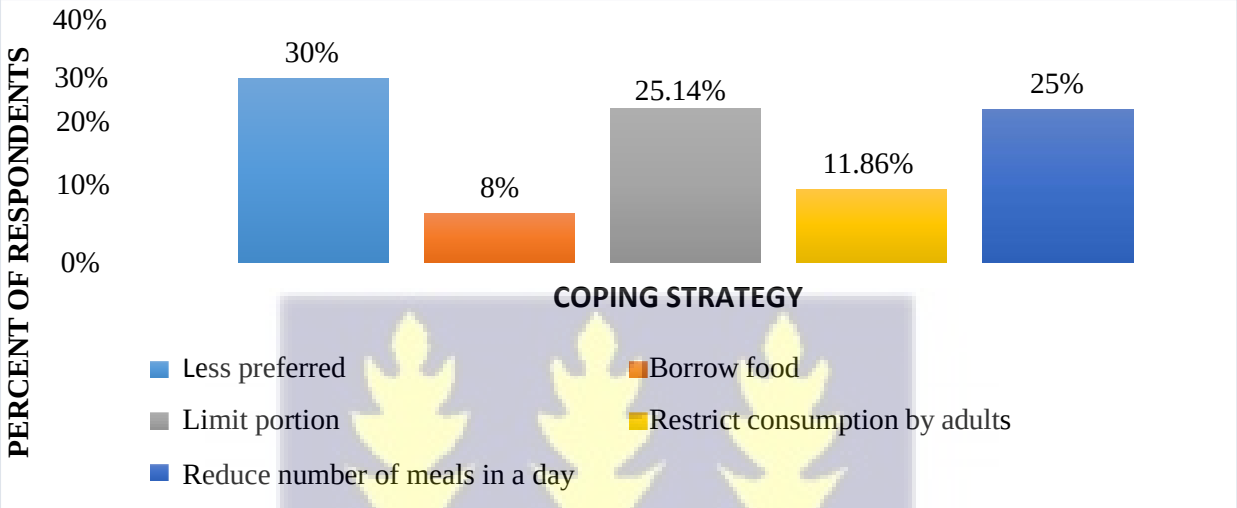
The least used strategy is the restriction of consumption by adults so that children can eat and borrowing food from family and friends. This result is quite similar to Adekoya (2009) who also observed that the least coping strategy used was borrowing food from friends and family and also skipping of food throughout the day.

The reason why most farmers do not go to friends and family to borrow food is because, most of them find it very humiliating and embarrassing to do this and therefore this is the last option they would prefer to use. This was discovered during the FGD with the farmers. The reason why most farmers do not use the restriction of consumption by adults in order for children to eat is because most farmers iterated that though sometimes, they do not have food available it is not that intense stage even though some farmers experience this, it is just a small fraction.

In order to find out the severity of each of the strategies adopted by the farmers, the farmers were asked to rank which coping strategies they find to be less severe and most severe. It was

revealed that eating less preferred food was considered as less severe, followed by limited portion size and reduction in the number of times eaten in a day were considered moderately severe, restriction of consumption by adults for children to eat was considered as severe and the most severe was the borrowing of food from family and friends

Figure 9: Coping Strategies used by Farmers to reduce their Vulnerability to Food Insecurity

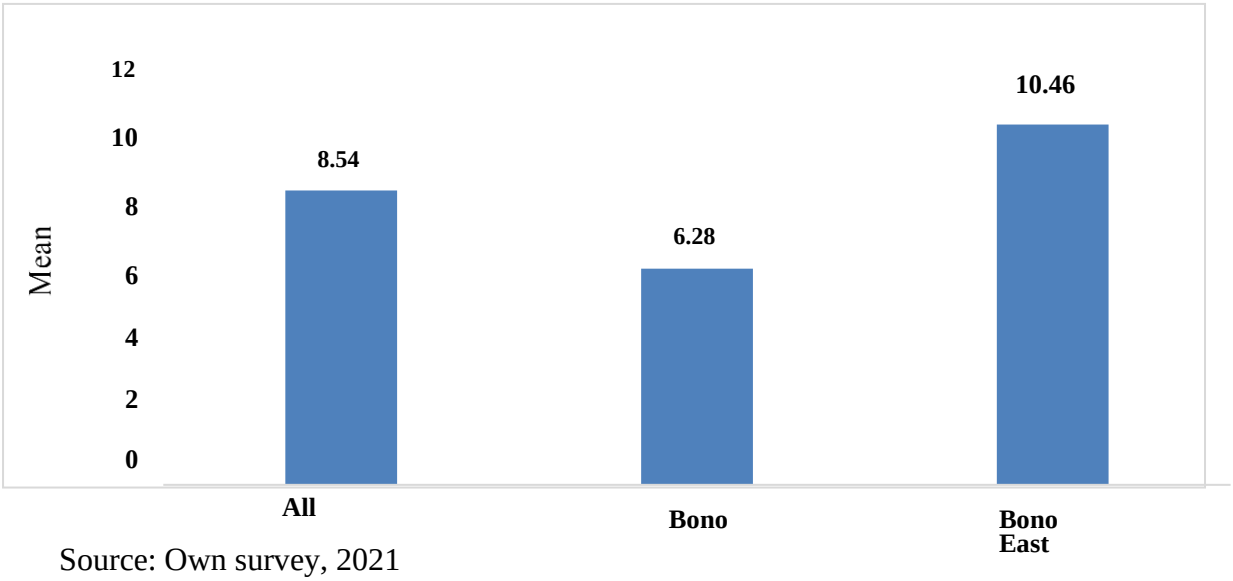


Source: Own Survey, 2021

4.4.1 Reduced Coping Strategies Index

The reduced Coping Strategies Index (rCSI) was computed to examine the coping strategies households employed to deal with food insecurity. The index ranges from 0 to 56, where the lower the rCSI, the more food secure the household, whilst the higher the rCSI, the more food insecure the household. The average reduced CSI varied significantly among the two regions surveyed (Figure 13). The Bono East region had significantly higher rCSI means than the Bono region as shown in figure 10 below. On average, households in the Bono East region adopted more coping strategies than those in the Bono region.

Figure 10: Comparison of Mean reduced CSI between Regions



Source: Own survey, 2021

4.4.2 Frequency of Coping Strategy Used Per Week

Table 17 reveals the frequency of coping strategies for households in the two regions. The result shows that cashew farmers in the study area adopted at least one of these coping strategies on a daily basis. The most frequently used strategy on a daily basis was relying on less preferred and less expensive food. The least methods used during the week were restriction of consumption by an adult in order for children to eat and also borrowing food from friends or family.

Table 17: Frequency of Coping Strategy Used Per Week in Situations of Food Shortage

Coping Strategy	Never	1-2 days / week	3-4 days / week	5-6 days / week	Daily
			Percent of households		
Rely on less preferred and less expensive foods	50.8	33.8	10.4	2.1	2.9
Borrow food, or rely on help from friends/relatives	81.7	12.9	4.2	0.8	0.4
Limit portion size at mealtimes	58.8	27.5	8.3	2.9	2.5
Restrict adult consumption in order for children to eat	80.8	8.3	5.8	3.8	1.3
Reduce number of meals eaten in a day	59.6	25.4	8.3	4.2	2.5

Source: Own survey, 2021

4.5 Examining the Food Security Pillars and their Relationships with Cashew Production.

The Structural Equation Model in Figure 11 shows the various relationships that exist between cashew production and food security in the study area. From the model, we can observe the relationship that exists between income and cashew production, income and food security and food security and cashew production

4.5.1 Relationship between Income and Cashew production

The result shows a synergy between income and cashew production. This is a result of the positive figure obtained on the directional arrow linking income and cashew production in the SEM. This could be explained by the high incomes generated from the sale of raw cashew nuts. This contributes to high household income demonstrated in Table 8 as well as farmers using the income to also increase their cashew production. This positive relationship shows that most farmers are expanding their acreages by planting new cashew nut seeds as a result of the high incomes obtained from the sale of raw cashew nuts. This is backed by several works of literature highlighting on the increase in cashew production in the study area (Boafo, 2019; Evans *et al*., 2014; Bannor *et al*., 2020).

Farmers through focus group discussions reveal significant investments being made into their cashew farms. These investments include the constant purchase of agrochemicals to prevent pests and diseases.

4.5.2 Relationship between Income and Food Security

The results from the SEM show that there is a tradeoff between income and food security. This is as a result of the negative relationship depicted by the negative coefficient generated by the SEM. This can be seen on the directional arrow linking income and food security. This is demonstrated in the SEM from Fig 11.

This could be attributed to cashew farmers not investing in food crop production as revealed but rather in cashew production as a result of high incomes obtained from the sale of the raw

cashew nut. This is demonstrated by the low food crop output produced by cashew farmers in the study area (Table 5). As mentioned above, this could affect their long-term food security status. Also based on literature incomes are invested into other household investment activities such as education, health, housing and other non-farm business activities rather than directly investing them in food crop production. This assumption is supported by a report produced by Janssen (2018), who found that commercialized households spend a greater proportion of their income on non-food products than on food in Vietnam.

4.5.3 Relationship between Food security and Cashew Production

From the results, it is revealed that there is a tradeoff between household food security and cashew production in cashew-growing households. This is a result of the negative coefficient generated by the SEM. This can be observed on the bidirectional arrow linking food security and cashew production in Figure 11.

This result is similar to Anderman *et al.* (2014) who also found a negative relationship between cash crop production and food security. The negative relationship between cashew production and food security could be a result of the food security status of cashew farmers being determined by incomes generated from the sale of the raw cashew nut or through their own food production. The income obtained would be used to obtain food from the market to attain food security as well as own food produced can also be depended on to achieve food security. However, in relation to cashew farmers being food secure through their own food produced, results from previous analysis made in the study show that farmers are not producing enough throughout the year hence cashew farmers have to depend on the market to be food secure. Dependence on the market is risky as high food prices can affect the farmer's food security status.

Furthermore, results of incomes being used as a means of attaining food security by cashew

farmers show that there is a negative relationship that exists between income and food security. This shows that although farmers spend on food from the market as demonstrated, this is in competition with other non-food items and therefore not enough to maintain the food security status of the household. This is quite contrary to an assertion made by Babu *et al.* (2014) that a household's income-earning potential from commercial crops will increase the household's spending potential on food from the market.

This evidence is consistent with the general assertion that cash crop-producing households for which cashew is classified utilize incomes from their cashew farming activities on household investment activities such as housing, education, health and other non-farm business activities rather than directly investing them to secure themselves against household food insecurity (Janssen, 2018). Also, cashew is not a crop that is generally eaten and therefore high production of cashew cannot be consumed as compared to food crops.

4.5.4 Examining Relationships that Exist in the Structural Equation Model (SEM)

Considering the overall household food security, which can be observed on the left-hand side of the SEM from Figure 11. The coefficient of Food Availability (Avail) is positive this can be seen by the positive figure of 0.93 generated on the directional arrow linking avail and food security. This implies that cashew-producing households with higher food production tend to increase food availability and food security. Evidence from the study however shows that food accessibility (HFIAS) exhibited a negative and significant relationship with household food security. This is depicted by the negative coefficient of -0.12 obtained in the SEM. This implies that accessibility tends to reduce household food security as high market dependence shows a high level of food insecurity in the household. This is an indication that own food being produced is not enough to feed the household. Also, in situations where incomes generated are not enough, farmers would not be able to get the same quantity of food needed to feed the household. In addition, if the priorities of a farmer are into acquiring household investments

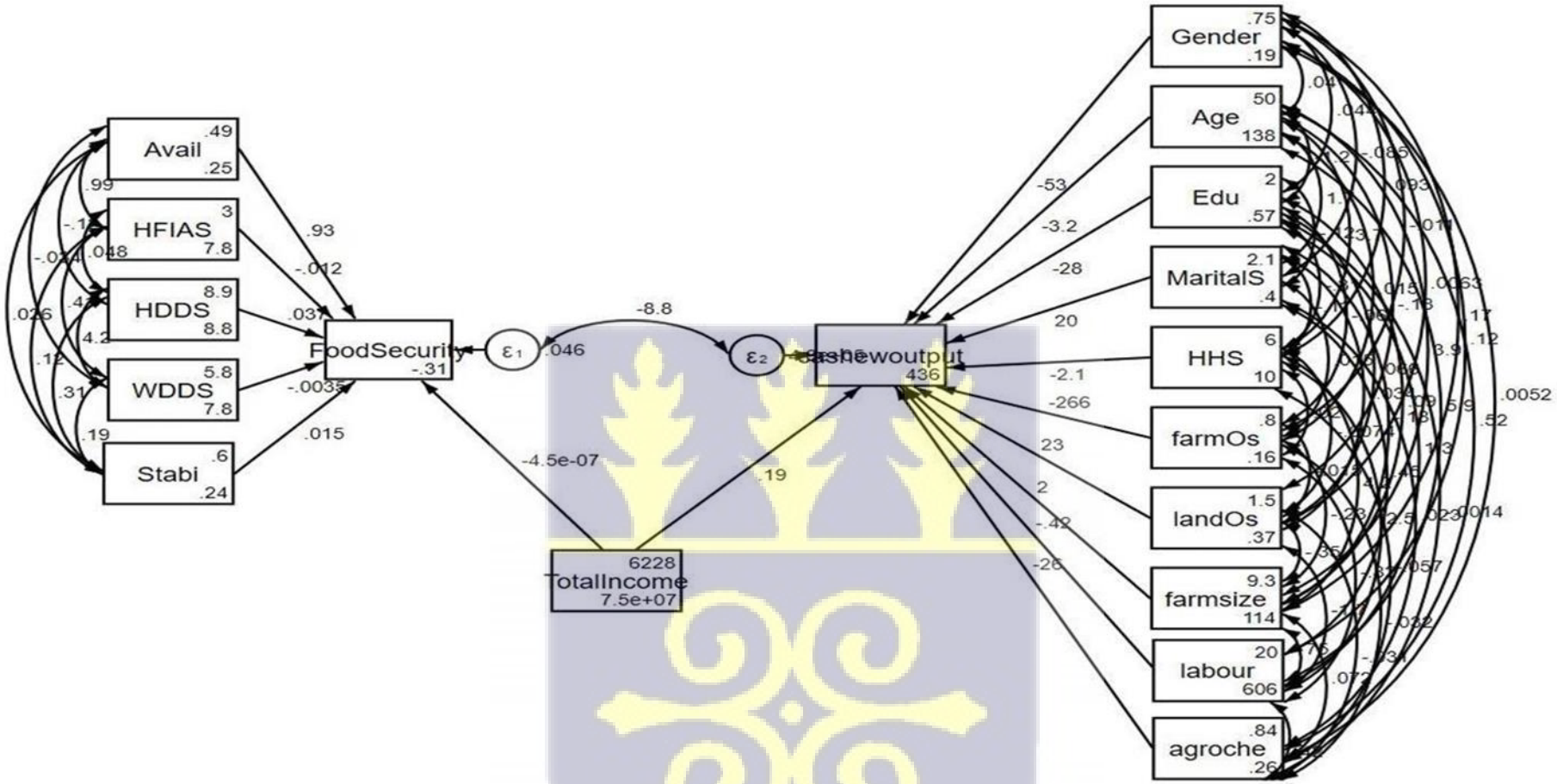
instead of food, the amount of income that would be spent on food will not be enough and this will cause a reduction in the food security status of the farmer. Also increasing market prices of food can affect the quantity of food that cashew farmers will be able to purchase and also cause their food security level to reduce.

Market access has a context-specific influence and therefore it may not necessarily translate into improved household food and nutrition security (Linderhof *et al.,* 2019; Ntakyo and van den Berg 2019).

From the study, household food utilization was proxied by dietary diversity indicators such as Household Dietary Diversity (HDDS). Specifically, results from the study showed that Household Dietary Diversity (HDDS) also exhibited a positive and significant structural relationship with the household food security status of cashew-producing households. This is depicted by the positive coefficient of 0.037 depicted on the directional arrow linking HDDS and food security in figure11.

This means that as cashew farmers increase the variety of the food groups consumed, the higher their food security status. Based on this, the hypothesis stated earlier is not supported as dietary diversity has a direct impact on food security. It is also observed that there is a positive relationship between household food security and stability. This is a result of the positive coefficient of 0.015 on the directional arrow connecting Stability (Stabi) and food security in the SEM. This means that when cashew farmers have food available or access to food all year round, the higher their food security status. On this basis, the hypothesis stated is not supported as stability affects food security.

Figure 11: Relationship between Household Food Security and Cashew Production



Source: Own Survey, 2021

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The chapter presents the summary of the key findings, the conclusion of the study and some recommendations based on the findings are presented in this final chapter.

5.1 Summary and Major Findings

The study sought to analyse the tradeoffs and synergies that exist between cashew production and food security. First, the study analysed the contribution of food crops produced by cashew farmers on food security based on four pillars of food security (availability, accessibility, utilization and stability). Secondly, it further analysed the determinants of food security and coping strategies used by cashew farmers. Lastly, examined the tradeoffs and synergies that exist between cashew production and food security.

Data for the study was collected using the quantitative (structured questionnaire) and qualitative (focus group discussion) means of data collection which was administered to 240 cashew farmers in the Wenchi Municipal, Tain, Sunyani west, Nkoranza south and Techiman North and South. The farmers were selected through a multi-stage sampling technique which used a combination of purposive and simple random sampling techniques.

Stata 14 software was used in the analysis of the study. The structural equation model was used to analyse the tradeoffs and synergies that exist between food security and cashew production while the Tobit regression model was used to analyse the determinants of food security. Months of adequate household provisioning were used to analyse availability, Household Food Insecurity Access Scale (HFIAS) was used to analyse accessibility, Household Dietary Diversity Score (HDDS) was used to analyse utilization and stability was measured using the perception of the seasonality of food items in the household and market as a result of factors

such as market price, crop failure and drought. The result of the study found that the majority (75 percent) of cashew-producing households were males as well as the majority of respondents were married (80percent) with a basic level of education. Also, the majority of respondents were found to be in the working age group with a mean age of 50 years old. The study revealed that cashew farmers also produce food crops such as maize, yam, cassava, plantain, tomato, pepper etc. However, in comparison to the national average production, the quantity of food crops being produced is low. The study also shows that majority of household incomes are spent on education and food.

The study revealed that food crops produced by cashew farmers are able to last for about 9 to 10 months of the year. The months that cashew farmers did not have enough food available were from May to July. This is because, during these months, most of the food crops planted are yet to be harvested hence low food availability. The study also revealed that cashew farmers had access to food. This is because cashew farmers were able to get access to the market when their own food production gets finished during some months of the year as indicated above. Hence, their relatively high expenditure on food.

Analysis of household dietary diversity revealed that they consume 9 food groups out of the 12 food groups assessed on with cashew farmers consuming more starchy staples. Lastly, the study revealed that farmer's food stability is also affected by factors such as crop failure, market prices, drought and the pandemic.

The study revealed that household food availability is threatened by factors such as age, marital status, household expenditure and access to the market. Food accessibility is also affected by factors such as gender, education, marital status, household expenditure and income. Food utilization is also affected by factors such as age, education, household expenditure, household size and distance to the market. Lastly, stability is affected by gender, education(tertiary), household expenditure, income and household size.

The study identified that the coping mechanisms frequently used by cashew farmers during the lean season include: eating less preferred or expensive food, limiting portion sizes and reduction in the number of times eaten in a day. Restriction of consumption by adults for children consumption and borrowing food from friends and family was the least coping mechanism employed.

The study identified 4 synergies and 2 tradeoffs that exist between food security and cashew production. The synergies identified include: (1) the positive relationship between income and cashew production (2) the positive relationship that exists between food availability and food security (3) food utilization and food security and (4) the positive relationship between stability and food security. The tradeoffs identified include:(1) the negative relationship between food security and cashew production and (2) the negative relationship between food security and accessibility.

5.2 Conclusions

Considering the main objective of the research, it can be concluded that the synergies between cashew production and food security are derived from food availability, utilization and stability. This shows that the food security of cashew farmers is reflected in their own food production. Hence increasing own food production and also diversifying food crop production ensures that farmers get access to a wide array of food which contributes positively to their dietary diversity. It also ensures that farmers have access to food all year round and hence increases or improves their food security status. In addition, the tradeoffs identified is the relationship that exists between food security and cashew production and the existence of food security through food accessibility. This is a result of cashew not being a food crop to be consumed and also income generated from the sale of cashew is not enough due to the seasonality of the crop. This situation affects farmer's ability to purchase food from the market all year round.

The study revealed that farmers depend on food crops produced as well as food obtained from the market. Food crops being produced are not enough to sustain them during the entire year as a result of competition for land between food crop production and cashew production. The food crops produced are also affected by factors such as crop failure, drought, fire etc. hence further reducing the quantity of food available.

The reliance on the market for attaining food security is not advisable as high food market prices can affect the quantity of food purchased and also affect the dietary diversity and food stability of cashew farmers. This situation has led cashew farmers to resort to using coping strategies such as eating less preferred or expensive food, limiting portion of sizes, reduction in the number of times eaten in a day, restriction of consumption by an adult for children and lastly, borrowing food from friends and family. The study also revealed the lack of diversity in food crops produced by cashew farmers hence the lack of diversity in the diet of farmers in the study area as farmers consume more starchy staples. This is worrisome as this can cause stunted growth amongst children and women in the household. The study also revealed that each of the food security indicators (availability, accessibility, utilization and stability) are determined by factors such as age, education, household size, household expenditure, income, and access to the market. The study revealed that as age increases, the level of food security reduces as farmers would not have the same energy to cultivate large quantities of food. Also, higher education positively affects food security whereby farmers can implement ideas taught by extension officers and also be able to know how to combine the different food groups to achieve a higher dietary diversity. Household size has a negative relationship with food security since the number of mouths to feed will be more hence a reduction in the quantity of food available. Income has a positive relationship with food security this is because high income can be used to obtain food from the market to supplement its own food produced.

5.3 Recommendations

Based on the study's findings, the following recommendations are made for policy action to be taken to help improve the food security status of cashew farmers.

The analysis from the study shows that although cashew farmers in our study areas devote land to food crop production, the food crops produced are not enough to feed their families throughout the year. This is also proven through the stability analysis where farmers who produce food crops do not have high yields as a result of factors such as crop failure, drought etc. Based on this, it is recommended that the Crops division of the Ministry of Food and Agriculture in partnership with extension service officers will engage in sensitization and awareness programs to encourage cashew farmers to increase agricultural production to make more food available for households and also support cashew farmers to diversify their subsistence food cropping into growing more vegetables (lettuce, carrots, cucumber etc.) in addition to starchy staples.

NGOs such as GIZ(Comcashew) and African Cashew Alliance should also educate cashew farmers to also engage in food crop production. The NGOs should build the capacities of farmers on productivity-enhancing and climate-smart practices to reduce food crop failure and extreme weather conditions such as drought.

Implementors of projects such as Comcashew should also support cashew farmers to improve upon their savings behaviour. This includes the encouragement of cashew farmers to participate in village savings and loan schemes. This will help farmers to have access to funds during the periods when cashew is out of season.

Cashew farmers in the Bono east region should also adopt good agricultural practices to increase their food crop production in order to catch up with farmers in the Bono region whose food security indicators are higher. Also, programs that support diversification or the development of alternative sources of income and food are critical in this regard. Supporting

livelihood diversification should target high-value products which farmers can sell to generate income. This includes training cashew farmers on how to process the cashew fruit into products such as vinegar, alcoholic drink and jams as it is done in some other countries such as India and Brazil. Cashew farmers could also be trained in beekeeping, grass-cutter and snail production to increase incomes. High incomes from these other revenue-generating sources will reduce the acreages dedicated to cashew production.

Ministry of Food and Agriculture should partner with nutritionists to educate farmers on the need to have a balanced diet and not only depend on starchy staples to improve dietary diversity Secondly, the Ministry of Food and Agriculture through the extension agents should educate farmers on the effect of some of the determinants of food security such as the importance of engaging in family planning since a higher dependency ratio within the households worsens the food security status of these farming households. Furthermore, since income has a positive relationship with food security, there is a need for farmers to have diversified sources of income to reduce their vulnerability to food insecurity. In addition, the Ministry of food and agriculture should encourage farmers to enroll in adult education classes to improve upon their level of education as well since achieving a higher form of education will improve their living conditions.

Lastly, the Ministry of Food and Agriculture should also educate farmers on the synergies and tradeoffs that exist between cashew production and food security. This will enlighten the farmers to increase food crop production to enhance their food security status. In addition, the crops division of MoFA should help farmers with issues such as pest and disease management, and the adoption of irrigation to increase the yield of farmers to ensure food availability and food stability. Farmers should be encouraged to diversify their crops to include vegetables to enhance their nutritional dietary diversity to improve their food security status.

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APPENDICES

CASHEW FOOD SECURITY ASSESSMENT TOOL

Household Questionnaire

General information

Community/village name	…….....	Name of respondent:	……..
District:	|.....|….|….|	Status of Respondent (head, wife):…….	
Region name:	……..	Telephone number:	|…|…|…|…|…|…|…|…|…|…|…|
Region code:	|.....|….|	Date of interview:	|.....|...….|…….|
		Name of Enumerator:	……..
Household ID:	|….|….|….|		

A. Household demographics and composition

Q No.	Question	Options		
A.01	Type of household?	1=Male headed 2=Female headed		
A.02	Gender of respondent?	1=Male 2=Female		
A.03	Age of the household head	|……| years		
A.04	Educational background of household head	0=No Education 1=Basic Education/Middle/JHS 2=SHS/Tech/Voc 3=Tertiary 4=Other (Specify)		
A.05	Marital Status of household head	1=Married 2=Single 3=Divorced 4=Widow/Widower 5=Cohabitation		
A.06	Number of people currently living in the household		|……| people	
	Number of children and adults currently living in the household?		Male	Female
		0-5 years	|…..|	|…..|
		6-17 years	|…..|	|…..|
		18-60 years	|…..|	|…..|
		+ 60 years	|…..|	|…..|

B. Food security questions

Q No.	Question and filters	Code
AVAILABILITY [Months of Adequate Household Food Provisioning]		

B.01	Now I would like to ask you about your household's food supply during different months of the year. When responding to these questions, please think back over the last 12 months, from now to the same time last year. Were there months, in the past 12 months, in which you did not have enough food to meet your family's needs? PLACE A 1 IN THE BOX IF THE RESPONDENT ANSWERS YES. PLACE A 0 IN THE BOX IF THE RESPONSE IS NO.		[…..] IF NO, END HERE
B.02	If yes, which were the months in the past 12 months during which you did not have enough food to meet your family's needs?	A. January	[…..]
		B. February	[…..]
		C. March	[…..]
		D. April	[…..]
		E. May	[…..]
		F. June	[…..]
		G. July	[…..]
		H. August	[…..]
		I. September	[…..]
		J. October	[…..]
		K. November	[…..]
		L. December	[…..]

ACCESSIBILITY [Household Food Insecurity Access Scale]

Q No.	Questions	Response options	Code
B 03	In the past four weeks, did you worry that your household would not have enough food?	0=No (Skip to Q4) 1=Yes	[…..]
B 03a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B04	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0=No (Skip to Q5) 1=Yes	[…..]
B04a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B05	In the past four weeks, did you or any household member have to eat a limited variety or the same type of foods due to a lack of resources?	0=No (Skip to Q6) 1=Yes	[…..]
B05a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks)	

		2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B06	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0=No (Skip to Q7) 1=Yes	[…..]
B06a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B07	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0=No (Skip to Q8) 1=Yes	[…..]
B07a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B08	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0=No (Skip to Q9) 1=Yes	[…..]
B08a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B09	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0=No (Skip to Q10) 1=Yes	[…..]
B09a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B 10	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0=No (Skip to Q11) 1=Yes	[…..]
B10a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
B11	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0=No (finished) 1=Yes	[…..]
B11a	How often did this happen?	1=Rarely (once or twice in the past 4 weeks) 2= Sometimes (3-10 times in the past 4 weeks 3= Often (more than 10 times in past 4 weeks)	[…..]
ACCESSIBILITY [Reduced Coping Strategies Index]			
B12	In the past 7 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to:		Frequency (0-7 number of days per week)

		a. Rely on less preferred and less expensive foods?	[…..]
		b. Borrow food, or rely on help from a friend/relative?	[…..]
		c. Limit portion size at mealtimes?	[…..]
		d. Restrict consumption by adults in order for small children to eat?	[…..]
		e. Reduce number of meals eaten in a day?	[…..]

UTILIZATION [Household Dietary Diversity Score, WDDS, CDDS]

Q No.	Questions and filters		Code
B.13	I would like to ask you about the types of foods that you or anyone else in your household ate yesterday during the day and at night, whether at home or outside the home. READ THE LIST OF FOODS. PLACE A *1* IN THE BOX IF ANYONE IN THE HOUSEHOLD ATE THE FOOD IN QUESTION, PLACE A *0* IN THE BOX IF NO ONE IN THE HOUSEHOLD ATE THE FOOD.		
	A.	CEREALS [corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these, e.g. bread, noodles, porridge or other grain products, or insert local foods e.g. porridge]	[…..]
	B.	ROOTS AND TUBERS + PLANTAINS [cassava, yam, cocoyam, potatoes, plantain, or other foods made from roots or tubers]	[…..]
	C.	VITAMIN A RICH VEGETABLES AND TUBERS [pumpkin, carrot, or orange flesh sweet potato, and other locally available vitamin A rich vegetables (e.g. red sweet pepper)	[…..]
	D.	DARK GREEN LEAFY VEGETABLES [dark green leafy vegetables such as *nkontomire* and locally available vitamin A rich leaves such as cassava leaves, spinach, etc.]	[…..]
	E.	OTHER VEGETABLES [other vegetables (e.g. tomato, onion, eggplant) and other locally available vegetables]	[…..]
	F.	VITAMIN A RICH FRUITS [mango, pawpaw and 100% fruit juice made from these and other locally available vitamin A rich fruits]	[…..]
	G.	OTHER FRUITS [other fruits, including wild fruits and 100% fruit juice made from these]	[…..]
	H.	FLESH MEAT [beef, pork, lamb, goat, rabbit, wild game, chicken, duck, other birds]	[…..]
	I.	ORGAN MEAT [organ meat such as liver, kidney, heart, or other organ meat]	[…..]
	J.	EGGS [eggs from chicken, ducks, guinea fowl or any other]	[…..]
	K.	FISH AND SEAFOOD [fresh or dried or smoked fish or shellfish]	[…..]
	L.	LEGUMES, NUTS AND SEEDS [dried beans, dried peas, lentils, nuts, egushie/melon seed, seeds or foods made from these (e.g. peanut butter)]	[…..]
	M.	MILK AND MILK PRODUCTS [milk, yogurt, cheese or other milk products]	[…..]
	N.	FATS AND OILS [oil, fats or butter added to food or used for cooking]	[…..]
	O.	SWEETS [sugar, honey, sweetened juice drinks, sugary foods such as chocolates, candies, cakes and cookies]	[…..]
	P.	SPICES, CONDIMENTS, BEVERAGES [spices (e.g. pepper and salt) condiments (e.g. hot sauce), coffee, tea, alcoholic beverages]	[…..]

STABILITY			
Q.No	Crisis	B. 14) In the past year has there been times when you have to reduce the amount of food available, purchased or consumed due to the following crisis	CODE
	A. Crop failure	0=No 1=Yes	[…..]
	B. drought	0=No 1=Yes	[…..]
	C. fire	0=No 1=Yes	[…..]
	D. pandemic	0=No 1=Yes	[…..]
	E. Market price changes	0=No 1=Yes	[…..]
	F. Other	0=No 1=Yes	[…..]

C. Agricultural production

Q No.	**Question**						
Cashew production							
C.01	For each plot of cashew farm holding please indicate the type of landholding arrangement and characteristics of cashew farms						
			Cashew farm holding or plot number				
			Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
	E.01a	1=Farm owner 2=Caretaker 3=Sharecropper					
	E.01b	Landholding type (1=Owned 2=Family land 3=Rented 4=Others					
	E.01c	State size of farm (area planted on this plot)					
	E.01d	Farm size unit (1=poles, 2=Acres, 3=Ha, 4=ropes)					
	E.01e	Is this cashew farm/plot bearing fruits? 1=Yes 0=No					
C.02	For each of the cashew farm holding please indicate the output						
C.03	What was your **output of dried cashew nut** from the different plots from2020 cashew season (both major & minor seasons)						
			Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
	E.03a	Major season output in bags (March 2020 – July 2020)					

	E.03b	Major season output in kg (March 2020 – July2020)					
	E.03c	Minor season output in bags (August 2020 – December 2020)					
	E.03d	Minor season output in kg (August 2020 – December 2020)					
C.04							

Food crops

C.05		Maize	Cassava	Plantain	Yam	Pepper	Tomato	Others
	Did you cultivate these food crops last season? 1=Yes 0=No	|.....|	|.....|	|.....|	|.....|	|.....|	|.....|	|.....|
	Indicate the area planted to these crops last season (in acres)	|.....| Acres	|.....| acres	|.....| acres	|.....|acres	|.....| acres	|.....| acres	|.....| acres
	What proportion of the crops area planted has been damaged or lost?	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%
	What proportion of the crops output harvested has been damaged or lost?	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%	|.....|%
	What was your output from the mentioned crops last season?	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg
	What quantities of the crops did you sell?	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg
	What quantities of these crops did you use for home consumption during the year?	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg
	What quantities (production, purchase, gift, food aid, etc.) did you have in stock after harvest	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg
	What quantities (production, purchase, gift, food aid, etc.) did you have in stock in mid-season							
	What quantities (production, purchase, gift, food aid, etc.) did you have in stock before harvest?	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg	|.....|kg
	How long did the stocks from own production last after harvest?	|.....| months	|.....| months	|.....| months	|.....| months	|.....| months	|.....| months	|.....| months

Livestock

C.06		Cattle	Sheep	Goats	Poultry	Others
	How many of these animals do you currently own?	|.....|	|.....|	|.....|	|.....|	|.....|
	Did you own these animals 12 months ago? 1=Yes 0=No	|.....|	|.....|	|.....|	|.....|	|.....|
	How many have you sold in the last 12 months?	|.....|	|.....|	|.....|	|.....|	|.....|
	If yes, please indicate the income received from the sale?	|.....|	|.....|	|.....|	|.....|	|.....|
	If yes, what was the reason for selling the animals? 1=Need of cash 2=Old age 3=Infertility 4=lack of fodder/animal feed 5=Others (specify)					
	Please indicate time of year animals are mostly sold? January, February, March, April, May, June, July, … , December.	|.....|	|.....|	|.....|	|.....|	|.....|
C.07						

D. Market access and participation

Q No.	**Question**	**Options**	**Code**
D.01	Do you have access to markets within the community?	1=Yes 2=No	|.....|
D.02	If yes, where is the market located?	1=Local market within the village 2=Local market in neighbouring village	|.....|
D.03	If yes, what is the distance from your home to the nearest market?		
		Distance in kilometres	|.....|
		Distance in minutes	|.....|
D.04	What is the cost of transportation to the nearest market centre per journey?	State the cost in Ghana cedis	|.....|
D.05	What is the condition of the road to nearest market centre	0=Paved and motorable all year 1= unpaved motorable all year 2= unpaved and not motorable all year	|.....|
D.06	What is the cost of transportation to paved roads per journey? (passenger or Cargo?)	State in Ghana cedis	|.....|

E. Farm Operational Cost for the Cashew Season: 2019 – 2020 Season

Items	Quantity	Price/unit (GHC)	Total (GHC)
Seeds			
Fertilizer if any specify			
Pesticides if any specify			

Fungicides if any specify			
Herbicides if any specify			
Labour (Paid)			
A. Clearing /weeding			
B. Planting of seedlings			
C. Pruning (including mistletoe)			
D. Spraying: Fungicides			
E. Spraying: pesticides			
F. Spraying: Herbicides			
G. Fertilizer Application			
H. Harvesting			
I. Transport of nuts			
J. Other Labour Cost			

F. Income sources

Q No.	Question			
Cashew income				
F.01	Please state the income from cashew for the major and minor seasons			
	E.01a	Major season income (March 2020 – July2020)	|.....| Ghana cedis	
	E.01b	Minor season income (August 2020 – December 2020)	|.....| Ghana cedis	
Other sources of income				
F.02	What are your other sources of income for the past years 2019/2020 and how much money did you receive per period?			
			Regularity of income flow [1=daily, 2=weekly, 3=monthly, 4=quarterly, 5=yearly]	Income from activity for 2020
	A. Sale of food crops		|.....|	|.....| GHS
	B. Other cash (tree) crops other than cashew		|.....|	|.....| GHS
	C. Sale of animals		|.....|	|.....| GHS
	D. Agricultural wage labour (employed for farm work)		|.....|	|.....| GHS
	E. Non-agricultural labour (employed for off-farm work, e.g. store guard, waiter, domestic worker)		|.....|	|.....| GHS

	F. Petty trading	|.....|	|.....| GHS
	G. Transport business	|.....|	|.....| GHS
	H. Artisan (handicraft, mason, construction work)	|.....|	|.....| GHS
	I. Salaried worker/pension/social security fund	|.....|	|.....| GHS
	J. Fishing/hunting	|.....|	|.....| GHS
	K. Remittances	|.....|	|.....| GHS
	L. Others (e.g. gifts, LEAP, etc.)	|.....|	|.....| GHS
F.03	Has your income changed in the past 12 months? 1=No change 2=Decrease 3=Increased	|.....|	
F.04	By how much has it changed, decreased or increased?	|.....|%	

G. Indicate your expenditures over the last year (2019/2020) cashew season

		Please indicate your expenditure on the following items in Ghana cedis for 2019/2020	**Expenditure per monthly period (GHC)**
	A.	B. Food purchase	|.....| GHS
	C.	D. Water	|.....| GHS
	E.	F. Public toilet	|.....| GHS
	G.	H. Sanitation – waste disposal	|.....| GHS
	I.	J. Education for children (mainly uniform, books,, school fees & transport)	|.....| GHS
	K.	L. Health/NHIS	|.....| GHS
	M.	N. Rent	|.....| GHS
	O.	P. Travels	|.....| GHS
	Q.	R. Funerals/social	|.....| GHS
	S.	T. Firewood/Charcoal	|.....| GHS
	U.	V. Electricity	|.....| GHS
	W.	X. Gas	|.....| GHS
	Y.	Z. Kerosene	|.....| GHS
	AA.	BB. Remittance	|.....| GHS
	CC.	DD. Others (specify)	|.....| GHS

Household assets	Please include items that are in working conditions only. Place zero (0) if respondent does not own item.	Indicate number or size of assets where applicable for 2019/2020.
	Motor car	|.....|
	Motor bike	|.....|
	Bicycle	|.....|
	Furniture	|.....|
	Sewing machine	|.....|
	Refrigerator/Freezer	|.....|
	Radio	|.....|
	Television /Video recorder	|.....|
	Electric/Gas Stove	|.....|
	Electric Iron	|.....|
	Electric Fan	|.....|
	Mobile Telephone	|.....|
	Canoe	|.....|
	Account with financial institution	|.....|
	Shares in a company/Treasury bill	|.....|
	Jewellery	|.....|
	Cloth: Dumas, Lace etc	|.....|
	Cattle	|.....|
	Sheep/Goats	|.....|
	Chickens	|.....|
	Non-farm business enterprise (eg a store)	|.....|
	Donkeys	|.....|
	Corn Mill	|.....|
	Fish ponds/fishing equipment	|.....|
	Other (specify.....)	|.....|

I. CAPITAL ASSETS

	Please include items that are in working conditions only. Place zero (0) if respondent does not own item.	Indicate number or size of assets where applicable for 2019/2020.
	Land farming	|.....|
	Warehouse	|.....|
	Irrigation system	|.....|
	Tractor	|.....|
	House	|.....|
	Vehicle for the business	|……|
	Motor bike for the business	|……|
	Others (Specify… .....)	|.....|

APPENDIX 2

COMMUNITIES SELECTED

REGION	DISTRICT	COMMUNITY	No. FARMERS SAMPLED
BONO EAST	Nkoranza South	Nkwabeng	6
		Nkoranza	3
		Akropong	3
		Dandwa	3
		Ayerede	3
		Ahyiayem	3
		Amponsakrom	3
		Nsugum	3
		Makyinmabre	3
		Bredi No 2	2
		Nankuma	3
		Sessiman	4
		Brahoho	3
	Techiman	Tanoso	6
		New Techiman	4
		Fiaso	6
		Wawasi	9
		Twumia Nkwanta	4
		Agosa	3

		Bonkwae	3
		Faaman	7
		Attakrom	5
	Techiman North	Ahenkro	3
		Sereso	5
		Akrofrom	2
		Amantem	1
		Aworoano	3
		Asueyi	5
		Aworowa	5
		Buoyem	4
		Jama	3
		Kokroko	5
		Krobo	2
		Mesidan	5
BONO	Sunyani West	Dumasua	9
		Odumase	3
		Mantukwa	4
		Nsoatre	7

		Esereso	2
	Tain	Abekwae No2	4
		Abekwae No3	6
		Attakrom	6
		Badu	11
		Nsawkaw	6
		Tainso	3
		Yabraso	5
	Wenchi	Kanease	10
		Wurompo	11
		Nchiraa	10
		Wenchi	11