

UNIVERSITY OF EDUCATION, WINNEBA

**ECONOMIC ASSESMENT OF DETERMINANTS OF
SMALLHOLDER CASHEW FARMERS' PRODUCTIVITY AND
PROFITABILITY IN THE BONO REGION OF GHANA**

ISAAC BEDIAKO TAKYI

MASTER OF SCIENCE

2020

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BONO REGION OF GHANA**

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**A dissertation in the Department of Economics Education,
Faculty of Social Sciences Education, submitted to the School
of Graduate Studies in partial fulfillment of the requirement for the award**

**of the Degree of Master of Science in
Economics Education
of the University of Education, Winneba**

DECEMBER, 2020

DECLARATION

Student's Declaration

I, ISAAC BEDIAKO TAKYI, declare that this dissertation, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole for another degree elsewhere.

Signature:

Date:

Supervisor's Declaration

I hereby declare that the preparation and presentation of this dissertation was supervised in accordance with the guidelines on the supervision of dissertation laid down by the University of Education, Winneba.

Name of Supervisor: Dr. Anselm Komla Abotsi

Signature:

Date:

DEDICATION

This work is dedicated to my parents who in their love, patience and subtle ways initiated and inspired me to pursue my studies up to this level.

ACKNOWLEDGEMENTS

First of all, I would like to thank the Almighty God for giving me the aptitude, endurance, determination and guidance throughout the ups and downs of my research work. Many people have put their effort towards the completion of this research paper, since it is not possible to mention all of them by their names, I would like to take this opportunity to thank them all for their effort and contribution they have made at different stages of preparation of this paper. I therefore express my general gratitude's to all who directly or indirectly contributed to this work.

However, I would like to set aside my special appreciation to my research supervisor Dr. Anselm Komla Abotsi for his excellent support and encouragement during preparation of this research paper.

My appreciation is extended to the community members from Jaman North and South district particularly Sampa division who were so patient in giving data and information sought for this study.

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ABSTRACT

The study examined the factors that determine the productivity and profitability of smallholder cashew farmers in the Bono region of Ghana. A total respondents of 222 smallholder farmers participated in the study. Questionnaire was utilized as the key instruments used for the data collection during the study and data was analysed using Stata computer software version 18.0 as the main statistical computing software for the study. The study explored the determinants of cashew production and profitability of the smallholder cashew producers in the Bono Region. Findings from the study demonstrate that, farm size, extension services, and physical capital constitute the predominant factors that contribute to smallholder cashew farmer productivity. Improvement in farm size, access to fertilizer and intensification of extension agents visits to these small holder had a greater potential to increase cashew nut productivity. Again, smallholder cashew farmers produce at a rational stage with efficient input combinations. The positive return to scale value less than one implies that, any additional increase in factor inputs will increases output produced. Their factor inputs combined are inelastic as the coefficient is less than unity. Based on the findings from the study, it can be concluded that, the cashew production among smallholder farmers is a profitable venture. Furthermore, factors such as pricing of cashew nuts, access to extension services and farm size have positive influence on profitability of the farmers. Farmers who have access to extension services are able to improve their profitability. Therefore the study recommends that, the smallholders should be given enough fertilizers at a subsidized cost to be able to improve their production outputs. Cashew buyers and other NGOs can supply the smallholder cashew farmers with fertilizers for free or at a very subsidies fees. The government program of planting for food and jobs under the ministry of food and agriculture should consider the cashew farming as priority areas so they that more attention can be given to the cashew industry players such as the smallholder farmers.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Globally, the production of cashew nut is rapidly increasing and constitute one of the widely exported cash crop particularly due to its significant contribution to poverty alleviation, economic growth, and rural development (Evans, Mariwah & Antwi 2015; Peprah, Amoako, Adjei & Abalo, 2018; Boafo, Appiah, & Tindan, 2019).The production of cashew nut occurs predominantly in many parts of the world including India, Philippines and Vietnam Brazil and in the Sub-Saharan Africa countries such as Tanzania, Nigeria, Mozambique, Benin, Burkina Faso, Mali and Ghana (FAOSTAT, 2018). According to Durodola (2018) about 2.1 million tons of cashew nut is produced annually which contributes significantly to economic growth and development globally. For instance, in 2016 production year, Vietnam produced the highest tons of cashew of about 1,221,070 tons, followed by Nigeria (958,860 tons), India (671,000tons), Cote d'Ivoire (607,300 tons), Burkina 78,533(tons) and Ghana (78,268 tons)

In Africa, Evans, Mariwah and Antwi (2015) reported that about 1,000,000 tons of cashews are exported from Africa per year while approximately 90% are exported as raw material to India and Vietnam where they then processed to finished products and finally exported to other parts of the world such as Europe and the US.

For instance, 2017, Nigeria produced about 220,000 metric tons of cashew nut which contributed significantly to the economic growth and development of the economy (Durodola, 2018). There has been a significant contribution from cashew production to the livelihood of the people in Africa. It is reported that, cashew production offer

income for about 50,000 farmers and offer employment for about 55,000 people in the supply chain in Africa (Adeigbe, Olasupo, Adewale, & Muyiwa (2015). Cashew constitute one of the major non-traditional cash crops grown as a smallholder crop in Ghana. According to Osei-Akoto, Opper, and Swatson (2005), in Ghana cashew production is dominated by small holder farmers presenting about 88% of cashew producers. It has been estimated that, the sizes of land produced by these stallholder's ranges from 0.8 hectares to 3 hectares maximum. In the recent time, cashew has received much attention as one of the tropical crops which contributes significantly to exports and GDP. Previous studies report that, in Ghana, cashew exports constitute about 6.1% while in the case of GDP, it accounts for about 18.2% of the Agriculture GDP. Extant literature articulates that, cashew alone contributes about 200,000 job opportunities in Ghana annually (MOFA, 2008). According to Ghana Business News (2018), Cashew production export contributes about \$197 million, to Ghana export GDP. Cashew production has become one of the major traditional exports in Ghana. Boafo *et al.*, (2019) articulate cashew production has contributed meaningfully to the standard of living in Ghana.

However, in Ghana, the production of cashew is in the hands of the small holder farmers who don't have the capacity to production on large scale and to maximize the cashew production potentials in Ghana (Evans, Mariwah & Antwi 2015). These stallholder farmers are constrained with several challenges which have negatively impacted on their productivity and profitability. Several factors such as climate change, financial constraints, lack of adequate productive inputs, unavailability of labour, and inaccessibility to productive land have consistently reduce the output from these smallholder farmers (Boafo, *et al.*,2019). For instance, in comparison of Ghana with other West African countries such as Ivory Coast or Benin, Ghana's cashew

sector, is a relatively small player and less advanced in fulfilling its potential (Heinrich, 2012). According to (Boafo, *et al.*, 2019), one of the major constraints that account for Ghana cashew supply gap is low productivity and the predominance of the stallholder farmers in the cashew sector. The issue of profitability and productivity in farming are very important and cannot be overemphasized. Previous studies suggest that, increasing productivity and profitability of agricultural products contributes to growth in farmers' income, agricultural market competitiveness, national income and economic growth (Peprah, Amoako, Adjei & Abalo, 2018; Wongnaa & Awunyo-Vitor, 2013).

Based on this, the dissertation sought to investigate the key determinants of the productivity and profitability of the smallholder cashew farmers in Ghana using the Bono Region as the study area. Given that, the Bono Region is the predominant cashew producing region in Ghana, in the region it received the expansion in the cashew farming business through farmer networks from Ivory Coast –Ghana border and along the communities in the region (Evans *et al.*, 2015). Importantly, Peprah, Amoako, Adjei and Abalo (2018) also emphasized that, the predominant nature of the cashew business in the Bono region was as a results of the recent efforts from donor agencies and Non-Governmental Organisations to support production of cashew nuts and other tree crops in the region. For instance, Adventists Development and Relief Services (ADRA), Technoserves, the United States Agency for International Development (USAID), and the German Development Agency (GIZ) have all played important roles in promoting cashew and tree crop production in the Brong Ahafo region. The reason is that, in Ghana, cashew production is considered as being of particular value for improving household incomes, as the nuts are sold in the 'hungry season' when no other crops are available. Cashews can therefore assume a critical

role in food and income security; this includes the use of cashew income for the purchase of critical inputs for food crop production.

1.2 Statement of the Problem

Traditionally, cashew production has not been widely perceived as an economic opportunity by Ghanaian farmers since the focus and support mechanisms of the government have been geared more towards other crops such as cocoa production and other crop with less attention given to the cashew production sector (Wongnaa & Awunyo-Vitor, 2013). Owing to this, reports show that, Ghana produces only 17% of its potential to produce the cashew nuts compared to nearby countries such as Benin, Ivory Coast which have similar comparative advantage but produce in greater tonnage than Ghana (ACI, 2010). For instance, according to FAOSTAT (2018), in the year 2016, Nigeria produced 958,860 tons of Cashew while other countries such as, Cote d'Ivoire and Burkina produced 607,300 tons and 78,533 tons of cashew nuts respectively. Nonetheless, in the same year (2016), Ghana produced approximately 78,268 tons which is far below the production potentials of the country. Previous scholars also conclude that, demand for cashew significantly exceeds the supply of coffee due to low productivity (Evans, Mariwah & Antwi, 2015; Peprah, Amoako, Adjei & Abalo, 2018; Boafo, Appiah & Tindan, 2019).

Consequently, recent studies such as Boafo *et al.*, (2019) and Peprah, Amoako, Adjei, and Abalo, (2018) argue that the low level of cashew production in Ghana is as a result of the non-performance of the small holder farmers who dominate in the cashew production sectors in Ghana. Unfortunately, Boafo, Appiah, & Tindan, (2019) and Evans, Mariwah and Antwi, (2015) conclude that, the low productivity cashew nut of the smallholder farmers widen the income inequality, poverty gap and deteriorating

standard of living among the rural cashew farmers and the rural households in the cashew grown regions such as Bono region in Ghana.

Based on this backdrop, it is evident that, if the smallholder farmers who dominate in the cashew production in Ghana are able to improve their productivity, it will contribute to rural poverty alleviation, improvement in income level, improvement in standard of living in the rural areas among others. Therefore, it is necessary for a study to be conducted to identify the key factors that influence the productivity and profitability of the small holder cashew farmers in Ghana. In spite of the low productivity levels of smallholder cashew farmers in Ghana, recent studies conclude that, till now studies that focused on the key determinists of productivity and profitability among smallholder cashew farmers remain limited in literature particularly in the context of Ghana and in particularly in the Bono region (Peprah *et al.*, (2018). As most of the previous studies have paid much attention to large scale producers of Cashew while the less attention is given to the smallholder farmers particularly in the Ghanaian perspectives. Extant literature indicates that, the cashew production in Ghana is dominated by the poor-resourced smallholder farmers yet little is known about their performance and profitability in the cashew industry (Boafo *et al.*, 2019). Therefore, to address the current research lacuna, this study investigates the key factors that influence the productivity and profitability of cashew nut production among smallholder farmers in the Bono region in Ghana.

1.3 Research objectives

The specific objectives of the study sought to:

- i. examine the determinants of cashew production in the Bono Region
- ii. examine the elasticity and productivity level of cashew production in the Bono Region?
- iii. estimate the profitability of the cashew production in the Bono Region
- iv. Identify the determinants of profitability of the cashew production in the Bono Region

1.4 Research Questions

- i. What are the determinants of cashew production in the Bono Region?
- ii. What is the elasticity and productivity level of cashew production in the Bono Region?
- iii. What is the profitability of the cashew production in the Bono Region?
- iv. What are the determinants of profitability of the cashew production in the Bono Region?

1.5 Significance of the Study

The cashew sector is dominated by the smallholder farmers Ghana yet they contribute less to the total cashew output in Ghana. This account for the low cashew production potentials in Ghana vis-a-viz the high demand for cashew in the global and domestic markets for the last decade. In view of this, the findings from this study makes significant contributions to policies, farmers, and literature.

The study identifies the key factors that influence the productivity and profitability of the smallholder cashew farmers in Ghana. The outcome will support the NGOS, Government agencies and Policy makers outline significant strategies to improve the

productivity of and profitability the cashew farmers based on the key drivers of the productivity and profitability of the smallholder cashew farmers investigated. Based on the results from the study, the government will be able to roll out programs and policies to improve those factors that discourage the factors to increase production while those factors that motive the smallholder farmers to increase profitability and productivity will be increased.

Again, the findings from the study will also inform the extension workers in their functions to educate the cashew farmers on how best they can improve their productivity. This will enhance the farmers' ability to adopt good technology, management practices and farming techniques to improve their farm yields, and profitability. This will subsequently contribute to poverty alleviation, and improve livelihood of the farmers.

The study also contributes to literature on the factors that influence small holder farmers; productivity and profitability in the context of Ghana and in the Bono region. This also fill the information gaps in relations to the application of the production theory. In this case, the findings from the study makes contributions to the Cobb-Douglas production function since it has been utilized as the theoretical basis of the study.

Finally, the outcome of the study serves as the sprig ball for future studies. In line with this studies and regarding the imitation of this study, the future studies can be informed and conceived out of this study. This will highlight a new direction for further studies in the area of productivity and profitability analyses in the cashew production in Ghana and in Africa as a whole.

1.6 Organization of Dissertation

The dissertation is organized into five main chapters with each chapter presenting a specific components of the dissertation. The chapter one discusses the background to the study, problem statement, research objectives, research questions and significance of the study.

Again, the Chapter Two outlines the review of related literature. The literature review is divided into three main parts namely: theoretical review, conceptual review and empirical review.

Further, the Chapter Three described the research methodology employed. The research design, study area, data collection procedure, sampling technique and data analysis procedure have been presented in this chapter. The econometric model for the analysis and the empirical estimation procedure have been outline in the chapter.

The chapter four presents the results and discussion of the findings. The results are presented in line with the research questions and objectives.

Finally, the Chapter Five discusses the findings, conclusions, and recommendations of the study. Limitations and suggestions for further studies have been also outlined in the chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter discusses the relevant related literature on factors contributing to production and productivity of cashew. The literature comprises the review of theoretical framework, conceptual and empirical stance. Again the conceptual review consists of the concept of cashew production, challenges of cashew production, concept of production among others. Similarly, the chapter presents the empirical review on the study on factors of cashew production, productivity, and production levels.

2.1 Review of Theoretical Literature

The ensuing sections discuss the background of relevant theories in which this study was anchored. The study mainly relied on the theory of production, productivity and profitability as discussed below

2.1.1 Production Theory

Production is the creation of goods and service to satisfy mankind. Then creation of goods and services involves the careful combination of factors of production such as land, labour, and capital (Itam, Ajah & Agbachom, 2014). The theory of production demonstrates the technical relationship between output produced and the set of inputs employed. According to the theory, functional relationship between the output produced and the various inputs is defined as production function.

To establish the individual or joint contribution of inputs to output it is necessary to establish a production function. The theoretical foundation of this study was built on the production theory specially the cobb-Douglas production function. In economics,

the most commonly used production theory relates to the Cobb-Douglas production model. This theoretical model defines the technical relationship between output and inputs in production. Earlier works by (Bao-Hong, 2008) revealed confirmed that this model was first proposed by Knut Wicksell (1851 - 1926) and later tested by Charles Cobb and Paul Douglas in 1928 for its statistical and empirical evidence. Unequivocally, this theory articulates that, production output is basically determined by the amount of labour and capital invested in the production process (Olubanjo & Oyebanjo, 2005).

These values are constants determined by available technology. The general neoclassical production function: $Y = F(X_1, X_2, X_3 \dots X_n)$ where Y is the output level, X_s are the inputs;

Based on this, the Cobb Douglas production function is given as

$Y = AK^\alpha L^\beta$ where Y is the output level, K denote capital and L represents labour inputs. Again, α and β are positive constants which denote the elasticities of capital and Labour correspondingly.

Output elasticity measures the responsiveness of output to a change in levels of either labour or capital used in production, *ceteris paribus*. These include the Cobb Douglas which is often used by researchers due to its simplicity and flexibility, linear, quadratic polynomials and square root polynomials. Others are semi-log and exponential functional forms.

2.1.2 Theory of Productivity

The concept of productivity relates to the ratio of output to inputs organized in the production process. Improving productivity has been the major aim of every producer given the available inputs combinations. Productivity is a fundamental concept in

production economics which describes the ratio of output to a set of inputs. The concept of productivity defines the market value of total output produced per the total amount of resources of inputs employed for the production (Mohammed, 2011). In the computation of market value of the output, the value of intermediate outputs or raw material are not considered. Productivity is usually computed by comparing the output or yield produced to a set of factors of production such as land, labour and capital. In agriculture, the concept of productivity plays a vital role. The aim of every producer is to maximize productivity thus, maximizing output while minimizing the inputs utilized (Mohammed, 2011). Productivity determines the competitiveness of production and demonstrates the extent of increasing agricultural yield produced. It is noticeable that, increase in agricultural productivity contributes positively to agriculture growth and development. According to Olujenyo (2010), productivity measures consist of some basic measures such as average product, marginal product, elasticity of production, returns to scale and Marginal Rate of Substitution.

Olujenyo (2010), noted that productivity measurement involves the use of basic concepts such as Average product (AP), Marginal Product (MP), Marginal Rate of Substitution (MRS), Elasticity of production (EP) and Returns to scale (RTS). Productivity can be estimated as the value of output divided by the value of total value of inputs employed. This is also known as Total Factor Productivity (TFP). In the cashew industry for instance, the industry is more of labour intensive. Hence labour as a factor of production is more crucial in the industry. Total factor productivity is difficult to estimate since all the values of the inputs or output cannot be estimated in its real sense. Therefore, partial factor production (PFP) is normally used. PFP is given by physical output (Q) over physical factor input (X) that is $(Y=Q/X)$.

2.1.3 Profitability

Profit maximization is the basic thrust for every producer who produces for market. The concept of profitability defines the relationship between profit levels obtained in the production period and the resources invested in the production to achieve the level of profit. Profits are measured in relationship to the efficiency of the inputs or resources invested in the production. Production output maximization contributes to profit maximization. This implies that, to maximize profit, the output produced should be maximized given the available resources constraints. Profitability is influenced by the margins between costs and returns per unit of production and the number of units sold, hence it is closely tied to efficiency and scale.

2.2 Review of Concepts used in the Study

This section discusses the basic concept and the context of the study. These concepts include the concept of cashew production, cashew products, determining factors of production of cashew among others.

2.2.1 Overview of world cashew production

Cashew (*Anacardium occidentale L*) is produced in many countries across the world. In Asia, cashew is predominately produced in India, Philippines and Vietnam. Among these countries, India is the leading producer of cashew. Similarly, cashew is produced in Southern America such as Brazil. In Sub-Saharan Africa, cashew is produced in countries such as Tanzania, Nigeria, Mozambique, Benin, Burkina Faso, Mali and Ghana. In all these countries, cashew is produced as a cash crop for export and domestic consumption. In terms of production levels, India is the leading producer of cashew globally. In the America, Brazil is the leading producer of cashes will in the sub-Sahara Africa, Tanzania produces the major portion of cashew tonnage

exported from Africa (FAOSTAT, 2018). According to FAOSTAT (2018), in 2016 for instance, Vietnam produced the highest tons of cashew of about 1,221,070 tons, followed by Nigeria (958,860 tons), India (671,000 tons), Cote d'Ivoire (607,300 tons), Burkina 78533(tons) and Ghana (78,268 tons) as presented in the Figure 2.1.

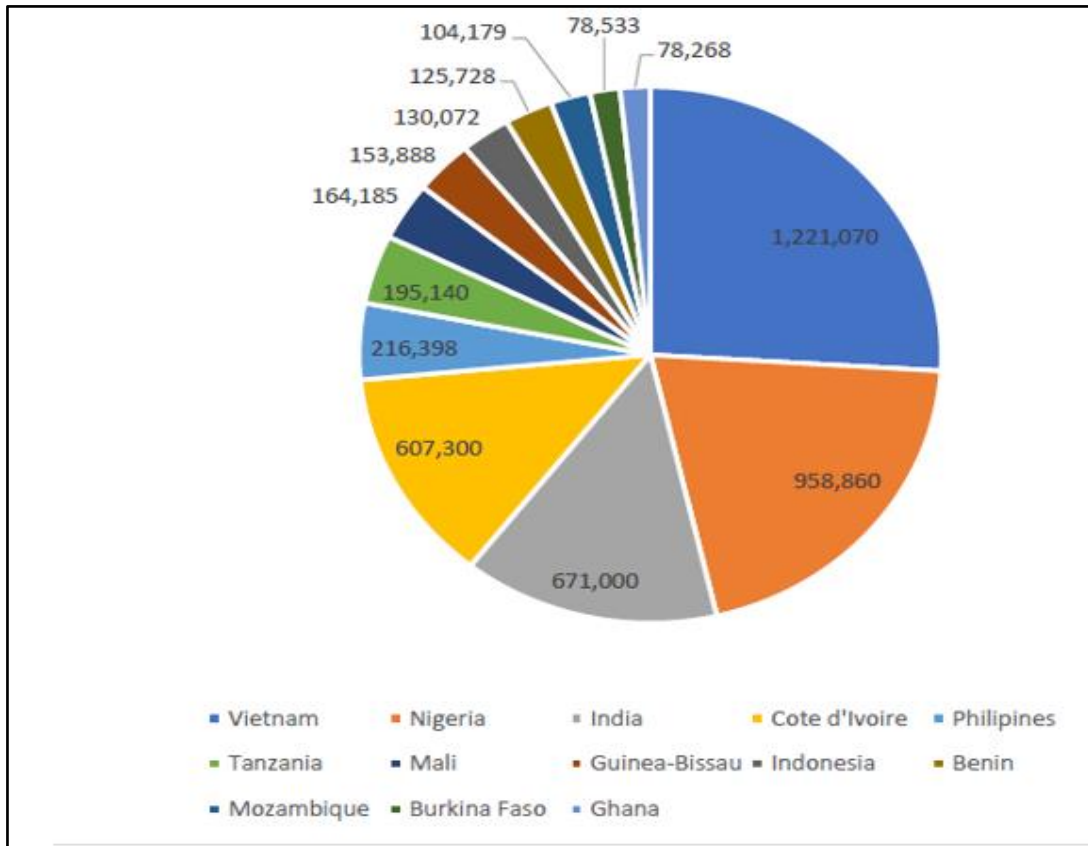


Figure 2.1: Quantity of cashew nuts (tons) for major producing countries in 2016

Source: FAOSTAT (2018)

2.2.2 History of Cashew Production in Ghana

Cashew production in Ghana had started in the early part of 1960 from some areas around the coastal belt especially in the central and greater Accra regions. According to Frimpong (2016), the cashew nut production then moved to areas in the upper East, Upper West, Northern and finally to the Brong Ahafo regions. In Ghana, the cashew production has become part of major cash crop such as cocoa, coffee and cotton. In the recent times, the cashew production has spread to all other regions in Ghana.

Cashew production has gained much attention due to its contributions to foreign exchange, economic growth and development. Cashew is currently produced in almost all the regions and its production is dominated by small holder farmers. African has a high potential for cashew production yet only small quantity is produced. It is reported that, Ghana has a huge potential for cashew production yet the level of output produced is far below compared to countries such as Tanzania, Nigeria, Ivory Coast and Benin (Heinrich, 2012). The figure 2 presents the production levels of cashew nuts in Kg/ha from early 90s to 2016.

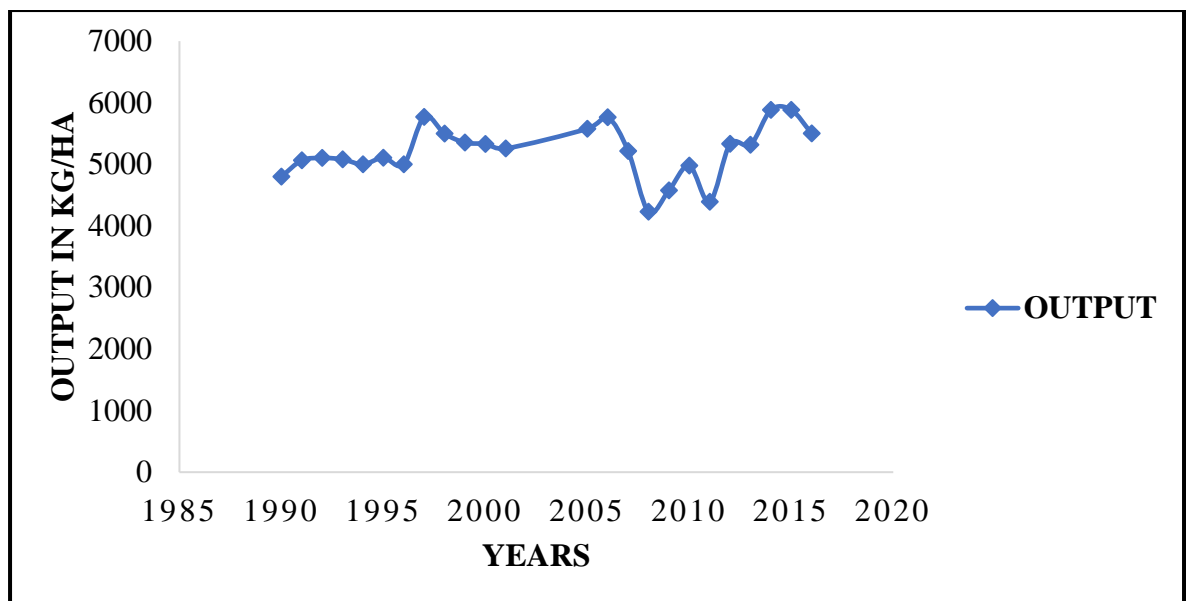


Figure 2.2: Output from cashew production in Ghana (1990-2016)

Source: MOFA, 2018

In Ghana, the cashew production are in the hands of the small holder farmers who only produce on a small scale and are faced with many challenges. Figure 2.2 presents to trend of the cashew production outputs in Ghana. Figure 2.2 shows that, output from cashew production has been fluctuating from 1990 till date. The figure shows that in 2008 Ghana recorded the least output of 4231kg/ha while the highest output level of 5882kg/ha was recorded in the 2015. According to the Agricultural

Development Fund (ADF, 2000), Ghana currently has an estimated land area of 18,000 ha employed in cashew production which is spread across the country. Meanwhile, there is the possibility to expand cashew production to cover 100,000 ha by the year 2020 (Agricultural Development Fund, 2000). This indicates that, Ghana has a huge potential to produce cashew for export and for the domestic market.

2.2.3 Benefits of Cashew Production

Cashew (*Anacardium occidentale L*) is one of the major cash crops largely cultivated in Ghana. Aside cocoa which is the most predominant cash crop cultivated in Ghana, cashew is among the other major cash crops such as oil palm, coffee, rubber, cotton, and tobacco cultivated in Ghana (Barbier, 2015). Cashew crop has several significant benefits to human health, diet, socio-economic development and environment. Previous scholars highlight that, relating to health, cashew has a major role to the healthy development of the body.

Cashew crop has very vital health benefits due to the high nutrient content contained in the cashew nuts. The cashew crop contains some important food nutrients such as protein, fatty acids, carbohydrates and oil which are good for development of the human body and prevention against disease (Soares et al, 2013). The cashew nuts also contain some minerals which are key for the normal functioning of the body systems. These vital nutrients are obtained when cashew nut is consumed directly as food and cooking oil. The cashew has a juicy fruit parts as well as a nut. Several other products such as cooking oil, soap, cake, drugs are produced from cashew. The juicy fruit part can be eaten raw as fruits while the nuts are further processed as food. Report indicate that, the cashew nuts contains about 20.5g/100g of carbohydrates, 21.3 g/100g of

proteins, sodium content is estimated to be 144mg/kg (Rico, Bulló, & Salas-Salvadó, 2016).

According to the Ghana Export Promotion Council (2005), in 2002, the country exported 3,893 metric tonnes of cashew valued at US\$1,450,306. This export figure increased by 79.15% in 2003 to 6,338 metric tonnes, which was valued at US\$1,598,636 (MOFA, 2007). Annual export of raw nuts reached 47,000 metric tonnes in 2006, contributing approximately US\$ 23 million in foreign exchange earnings. This figure is considered small when compared with world excess demand of 430,000 metric tonnes of raw nuts, valued at US\$270 million, and growing at a rate of 5-8% per annum (MOFA, 2007). A means of substantially solving the demand-supply gap aforementioned is by embarking on increasing small scale cashew production. However, the rationale of this effort must be anchored on the analysis of the profitability and viability of cashew production (MOFA, 2007). Therefore, this study was designed to assess the profitability of cashew production in Ghana. In 2008, raw cashew nut exports from Ghana contributed 6.1% of GDP and 18.2% of agricultural GDP (Osei-Akoto, 2010). It has been estimated that the cashew sub-sector can contribute to economic growth by generating over 200,000 permanent and seasonal jobs, particularly for farm labourers and intermediaries (MOFA, 2008). Furthermore, off-farm marketing, distribution and processing of cashew nuts offer more than 5,000 permanent and seasonal jobs annually (MOFA, 2009). The first ever recorded exports of cashew nuts from Ghana was in 1991, amounting to 15 metric tonnes and rose to 3,571 metric tonnes in 1997 (MOFA, 2007).

Cashew production contributes meaningfully to rural economic development and livelihood (Monteiro et al., 2017). In the rural areas, cashew production serves as a major source of income to cashew farmers and their households. Cashew production has become a major economic buffer for most of the rural households. In Ghana, cashew production is considered as being of particular value for improving household incomes, as the nuts are sold in the 'hungry season' when no other crops are available. Cashews can therefore assume a critical role in food and income security; this includes the use of cashew income for the purchase of critical inputs for food crop production.

It noted that, increasing productivity and profitability of agricultural products contributes to growth in farmers' income, agricultural market competitiveness, national income and economic growth. On the environmental benefits, the cashew plant has been identified to contribute to soil conservation and improvement. Since the cashew is a shrub which does not grow tall has the ability to cover the surface of the soil and prevent soil erosion.

2.2.4 Cashew Products

The cashew nut has been used for several products as food, polymer, and automotive products. The cashew shell contains a corrosive phenol, Cashew Nut Shell Liquid (CNSL), which must be extracted from the kernel. The CNSL has many applications such as in the polymer-based industries which is the most important use in the manufacture of brake linings and clutch facings in the automotive industry. Cashew by products are used as butter and vitamin juice. The broken kernels for the cashew nuts are used to produce butter for consumption (Hammed, Anikwe & Adedeji, 2008), the fresh fruity part of the cashew fruit is used to produce cashew juice which is very

rich in vitamin C. Cashew products have also been used to produce pistachios and cashew nuts. It is reported that; Cashew is among the most popular nuts that have high demand even though it is very expensive. According to Topper (2002), the cashew products have low levels of saturated fats and soluble sugars. They have been found to contain high percentages of proteins and polyunsaturated fatty acids to which have high ability to reduce cholesterol levels in the blood and have high levels of mineral salts. The cashew kernel is used in the snacks, confectionery and bakery industries consumed as snacks. Kernels are popular as a roasted and salted nut for snacking, and whole, larger kernels are preferred for this purpose.

2.2.4 The determinants of Cashew Production in Ghana

2.2.4.1 Land

Land appears to be one of the most important productive assets of rural residents in developing countries and for the production of cashew. Therefore, how land is accessed and used has far reaching implications for productivity, equity, and overall economic growth of rural communities in Ghana. The land tenure systems practiced poses a lot of challenges to cashew production in the African countries especially in Ghana. Land tenure is the ownership and uses of land. The land tenure system in Ghana is such that land acquisition is determined by customary and cultural factors such as family stems, clan and inheritance. In Ghana, there are two main types of land ownership systems namely: customary land ownership and public land ownership. According to Sittie, (2006), the customary land ownership is the situation where lands are owned and controlled by the family, clans, kings, stools and the family heads. Similarly, the public lands are owned and controlled by the government. There is a noticeable challenges of the impact of land ownership on cashew production in Ghana.

According to Donnelly, 2014) the issue of land tenure system limit the access to productive land for the production of cashew in Ghana. Since most of the lands belong the royals of those who originally settled in the locality for the first time, it makes is difficult for the non-royals and migrants to acquire land for farming. The land tenures systems where lands are own by a group of people, the avails farming lands are shared among the family members such that, it becomes difficult for establishment of plantation farms. Large scale cashew plantation farms are usually not possible under family land tenure systems. In most rural African communities including Bono region, customary systems determine access, use and transfer of land.

With increasing population, there is need for smallholder farmers to increase production with sustainable agricultural practices to preserve natural resource base and the environment (Agleby, 2019). Large scale acquisition by foreign investors dispossesses smallholder farmers from their lands and even speed up land degradation. To increase production, most of the farmers go into agricultural practices with very small acreage of land for the production of cashew. With increased pressure on lands available for cashew production, family heads have little control over which land should be sold and which should be left for smallholder farmers. This has led to serious conflicts and dispute so much so that it is currently affecting agricultural practices and production of smallholder farmers due to the fear of being assaulted in the farm or losing their precious land upon which their livelihood is sustained.

2.2.4.2 Capital

In the cashew production, access to adequate capital for production has always be a problem to the smallholder farmers. These farmers lack the access to adequate capital

to run their farming activities. The smallholder farmers do not have access to credit facilities, money lenders, banks loans and hence rely on family members and personal savings to generate small capital for their farming activities (Frimpong, 2016). Studies show that, in the event where there is availability of credit facilities to the small holder farmer, huge collateral security is required as surety for the loan or credit. This in effect prevent the small holder farmer who does not have any meaningful asset to use as collateral for credit or loan from banks or microfinance institutions. According to Uwagboe, Adeogun & Odebode (2010), lack of adequate capital to smallholder farmers has negative impact on the cashew production. Cashew farmers need money to purchase chemicals such as pesticides, weedicides to control pest in their farms. Nonetheless, due to lack of adequate funds, several losses occur and farmers also produce on very small scale. This accounts for the reasons why cashew is produced on very low quantity in Ghana.

2.2.4.3 Labour

Cashew farming by nature is labor intensive especially during harvesting and processing. In addition, the juvenile stage of cashew seedlings requires the use of weedicides to control the weeds as well as the use of pesticides to improve the flowers and fruits' quality. Poor access to labour limits the quantity of cashew output produced and the size of acreage farmed (Evans, Mariwah & Antwi 2015). Since the poor smallholder farmer does not have access to labour, they rely on their own effort, family support and sometimes child labour which do not allow them to expand their sizes of farms and limit outputs (Peprah, Amoako, Adjei & Abalo, 2018; Bofo, Appiah, & Tindan, 2019).

2.2.4.4 Storage facilities

Storage facilities for cashew nuts plays a crucial role in cashew production and sales. Most of the farming areas in Ghana do not have a well-structured storage facility to store harvested cashew nut for long periods (Evans, Mariwah & Antwi 2015). According to Evans et al., (2015), the smallholder farmer does not have these storage devises to store the cashew produced which results in post-harvest losses. The quality of the nuts and kernel reduces due to lack of appropriate storage devices. In most cases, since the farmers are not able to store the cashew harvested, they then sell them at very cheap prices (Peprah *et al.*, 2018). This makes the famer worse-off, their incomes are not improved and their living conditions worsened.

2.2.4.5 Pest and Diseases

There is increasingly wide spread of pests and diseases that attack the cashew crop and reduce the productivity of the cashew species. Pests such as stem borer and root borer have server impact on the cashew. These pests destroy the stem, and the roots and cause damage to these parts of the cashew tree. According to Catarino, Menezes, & Sardinha (2014), the pest and diseases in the cashew production contribute to a major losses in the cashew production. The control of these pests involve huge cost as a results cashew farmers who are mainly the poor smallholder farmers cannot afford to purchase those chemicals to control the diseases and pest (Adedeji, Anikwe, & Hammed, 2008). Again, in Ghana, the technology to deal with these pest and disease are lacking in the cashew growing areas hence the difficulty in the fight against the cashew pests and diseases. Pests and diseases control has been a challenge due to the high investment farmers have to make to control pest in the light of credit facilities unavailability.

2.2.4.6 Extension services

Farmers' access to agriculture extension services in the cashew industry has become a challenge to farmers. The extension service officer provides adequate knowledge and practical activities for the former to improve their agronomic practices, adoption of new technology and method of farming. The agriculture extension services providers serve as a liaison between agriculture researchers, the policy experts and the farmers. They carry information from the meteorologists, researchers, and policy makers to the farmers. According to Nhantumbo, Takeshita, Uaciquete, & Miura (2017), extension officers have a vital positive role to play in the cashew production. They support the However, most of the cashew farmers in Ghana do not have access to agriculture extension service officers hence they lack adequate knowledge on the adoption of innovative agronomic practices, knowledge on how to control diseases, marketing, harvesting and storage have negative effect of cashew production in Ghana. Findings from Anik, & Salam, (2014) suggest that extension officers have positive impacts on cashew output such that, the more the farmers have access to extension farmers, the greater their outputs. The extension officers teach the farmers the best practices to improve their productivity of the farm ventures.

2.3 Review of Empirical Literature

Mallya (2013) examined the socio-economic factors that affect cashew production in Africa specifically in the Ruangwa District Council in Tanzania. In the study, a sample size of 200 respondents were used. The multiple linear regression technique was used for the analysis of the data collected. Through the multivariate OLS regression, the production function was estimated for the study using SPSS version 16.0 and STATA version 9.0 computer software. The study considered cashew farms with minimum size of 4.125 acres. According to Mallya (2013), some socioeconomic

factors such as size of farm, extension services, price and quantity of fertilizer were statistically significant factors that determine the production of cashew nut in the study. These factors were positively related to cashew nut output and were statistically significant at 1% level of significance. Again, the study found that, physical capital and education had statistically significant impact on cashew nut production in Tanzania. Similarly, the results showed that, secondary education, and labour had negative impact of cashew nut output and were statistically at 5% level of significance.

Study by Wongnaa (2013) in Ghana focused on examining the economic determinants of cashew production. In the study, a sample size of 140 respondents randomly selected participated in the study. The production function analysis was estimated for the study. The OLS regression was used for the analysis of the data and for the estimation of the coefficients of the variables. To obtain a robust result, the Cobb-Douglas production function was transformed to satisfy the Classical Linear Regression Model (CLRM) According to Wongnaa (2013), the small holder farmers of the cashew nut production were aging while majority of the farmers had worked in the cashew farming for more than 5 years. Again, the results show that, about 61.4% had no formal education and remain illiterate while the minimum size of cashew farms was 3.33 cares. The finding from the study further demonstrated that, farm size, education background, access to extension services, fertilizers and pesticides have positive impact on cashew output in the study area. Also the results suggested that, labour had negative and inverse relationship with cashew output. Most of the cashew farmers in the study area (70%) have no contact on a regular basis with extension agents. Also, a greater proportion of cashew farmers in the Municipality (65%)

financed their production through personal savings. That is most farmers do not receive financial assistance in the form of credit from formal sources.

In the case of Mozambique, Cashew nut production is predominantly among the leading cash crops exported. According to Mole (2000), there are millions of smallholder farmers who are into the production of cashews in Mozambique, however, the cost and returns on production of the cashew nuts are less explored. In line with this, Mole (2000) investigated the output levels of the cashew production in Mozambique and the factors that account for the productivity of cashew among the small holder farmers. The identified that, the cashew farmers have some homogeneous characteristics such as those small holders who have less land size but labour abundant, farmers with large land size but lack labour to undertake a more profitable and labour intensive cashew production activities.

Again, Mole (2000) found that, factors such as market availability, access to labour and land acquisition determines the productivities of the cashew farmers in the study area. The study outlined that, cashew farmers with constrained labour need more incentives to be able to improve their productivities and adoption of integrated production activities. The study also articulated that, the production of the cashew nut contributed to solving rural food security, improving rural incomes and alleviating rural poverty.

Furthermore, a study by Agbongiarhuoyi, Uwagboe, Ibiremo, Olasupo, and Aigbekaen (2014) investigated the contending factors that contribute to low yield of cashew nut in Nigeria. The study examined the socio economic factors causing low yield, sources of cashew planting materials and the sources of information to the cashew farmers. The study used as sample size of 160 respondents randomly selected

using the multi stage sample technique. The study also used the descriptive statistics and chi-square as the two main statistical tools for their analysis. The results from their study showed that, the mean age of the cashew farmers was 52 years with majority of the farmers having worked as cashew farmers for more than 16 years. Findings on the output show that, the average yield of cashew was 10bgs where one bag was measured as 80kg. The cashew farmers obtain their planting materials for their colleague farmers and their own stock while their major sources of information is from the colleague farmers.

Uwagboe *et al.*, (2014) concluded from the chi-square analysis that, there was a statistical significant differences between insect pest attack, poor cashew price, lack of improved variety, farm abandonment, and high cost of farm labour, inadequate farm maintenance, no government support and yield of cashew.

Tamba (2017) articulated that, cashew crop is a major cash crop in Tanzania to contribute to foreign exchange to Tanzania in Africa. The cashew production remain a major sources of income to many farmers and livelihoods for the rural dwellers. In spite of the vital role of cashew in the economic growth and development of the Tanzanian economy, the production potentials of the cashew nut have not been achieved. In line with this problem, Tamba (2017) investigated the extent to which the production potentials of the cashew can be achieved in Tanzania and the factors causing the low productivity in the cashew production. The author used case study approach to identify the core factors in the study areas contributing to the low productivity in the cashew production. A sample of 120 respondents was randomly selected from 10 randomly selected. The average farm size in the study area was 1.5 acres while the maxima land size was 10acres. Major challenges encountered by

respondents include pests and diseases, climate change, untimely delivery of subsidized inputs such as sulphur, high prices of unsubsidized inputs, and lack of credits to farmers. About half of the respondents showed positive perceptions on AEA's effectiveness on dissemination of Good Agricultural Practices (GAPs).

The author found that, there was a low space of information dissemination on good cashew farming practices which account for the low productivity in Tanzania. Again, the ineffectiveness of the agriculture extension agents in the area account for the low productivity in cashew production in the area.

Wongnaa and Awunyo-Vitor (2013), examined the socio economic characteristics of smallholder cashew farmers and the profitability of cashew production in Ghana. The data for the study was collected from 2009-2010. The study used the profitability measures such as net present value, internal rate of return and benefit-cost ratio to determine the profitability of the cashew production. Wongnaa and Awunyo-Vitor (2013) found that, a one-hectare cashew plantation has a net present value of GH¢260.82 (\$343.16) when discounted at 25%, a benefit-cost ratio of 1.13 and an internal rate of return of 43.85%. These profitability values indicated that, the cashew production in Ghana can be described as profitable. The results also indicated that, Labour input plays a very important role in cashew production. It was noticed in the study that, employment in the cashew production in the area would possibly reduce rural-urban migration.

2.4 Research Gap and Chapter Summary

Majority of these previous studies conclude that, the cashew production in Ghana is dominated by small holder farmers who rely on the cashew farming for their livelihood. Given the vital role of cashew as one of the major cash crops in Ghana, it

was noticed that the productivity and profitability of the cashew nut production in Ghana till date has not been explored fully particularly in the case of small holder farmers. To address this research gap, this present study examined the factors that determine the productivity and profitability of cashew production of smallholder farmers in Ghana.

The chapter two presents the review of related literature on the research problem and its related theories and concepts. The literature review is divided into three main parts namely: theoretical review, conceptual review and empirical review. The production theory formed the main theoretical framework of the study. The Cobb Douglas production functions was discussed under the theoretical framework. The concept of productivity, profitability, cashew production among other have been discussed in the chapter.

The review of the related literature revealed cashew nut production in Ghana has received a growing attention in research and policy decision-making. It was noticed from the extant literature that, most of the previous studies focused on the factors that influence the production of the cashew, the challenges faced by cashew farmers and how to improve the cashew production industry.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter discusses the various methods and techniques employed in the study to collect data and analyse the data collected in line with the research objectives. The research design, study area target population, sample size, sampling techniques, data analysis and econometric model estimation have been outlined in the chapter.

3.1 Research Design

The study employed the quantitative descriptive survey research design to comprehensively address the research questions outlined in the study. According to Creswell (2014) the quantitative descriptive survey research design has a greater advantage of providing a robust approach to naturally identify the research problems, elicit the needed data from respondents without any potential manipulation of data. This research design tends to produce results which are more objective and reliable (Kothari, 2004). With this design, the study was able to address the extent of the rosewood exploitation and utilization in the study area without any manipulation of the data. Again, with this research design, the appropriate economic valuation techniques were utilized.

3.2 Theoretical Model Specification

The study relied on the production function model for the analysis of the data. The Cobb-Douglas production function which technically relates output to inputs formed the basic foundation of the theoretical analysis.

The production function is given as:

$$Y = f(L, K) \quad (1)$$

$$Y = bL^\alpha K^\beta \quad (2)$$

Where:

Y = total production (the monetary value of all goods produced in a year)

L = labor input (the total number of person-hours worked in a year) K = capital input (the monetary worth of all machinery, equipment, and buildings)

b = total factor productivity

α and β = the output elasticities of labour and capital, respectively.

Based on this, to estimate the socioeconomic factors influencing the cashew productivity, the equation is given as:

$$Y=f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, u) \quad (3)$$

Where; Y denotes the productivity, and X 's represents the explanatory variables of the socioeconomic factors.

3.3 Empirical Specification Model

The Cobb-Douglas production functions used focused on Log-log functions. Hence the empirical econometric model was given as:

$$\begin{aligned} \text{Log}Y = & \alpha + \beta_1 \text{log}X_1 + \beta_2 \text{log}X_2 + \beta_3 \text{log}X_3 + \beta_4 \text{log}X_4 + \beta_5 \text{log}X_5 + \beta_6 \text{log}X_6 + \\ & \beta_7 \text{log}X_7 + \beta_8 \text{log}X_8 + \beta_9 \text{log}X_9 + U \end{aligned} \quad (4)$$

Y =Total productivity of cashew produced in a year (Kg) measured using total output as proxy for productivity.

X_1 =farm size (ha)

X2=value of land (Ghana Cedis)

X3=price of cashew (Ghana cedis)

X4=Labour in man days

X5=Gender (male=1, female=0)

X6=Age (years)

X7=Educational level (years)

X8=Farming experience (years)

X9=Family size (hectors)

U=Error term

(β 's) = the coefficients

This model was estimated using the multiple regression model.

3.4 Study Area

This study sought to examine the determinants cashew production among the small holder farmers of in the Bono region in Ghana where greater quantity of cashew nuts in Ghana is produced. In this study the Bono region was chosen due to the production and also based on the national stoking inventory statistics. The Bono region was one of the new regions created in 2020 during the NPP administration. The region was formerly part of the Brong Ahafo region before its split to become independent. The region has Sampa as its regional capital with eleven districts. The Bono region has a vast area of vegetative cover with forest contain several cash crops. The predominant economic activities in the region include Farming and the major crops cultivated are cocoa, cashew and maize. In the region, cashew is predominantly produced in two districts namely the Jaman South and Jaman North. The climatic conditions of the region are moderate as unit experiences a dry season during the period December –

April and the Wet season during July-November. The Bono region records an average annual rainfall of 750-1050mm. the temperature recorded in the region is varies between fourteen (14) degrees Celsius and 40 degrees Celsius.

3.5 Population and Sample Size

In this case, the smallholder farmers producing the chew nut in the Bono Region formed the target population for the study. In the Bono Region, the production of cashew occurs predominantly in the Jaman North and Jaman South districts. Hence the study was conducted specifically in these two districts. Based on report from Olam Cashew buyers in the Region, it is estimated that about 500 small holder cashew farmers produced cashew nuts during the 2018/2019 cashew production year in the two districts. Therefore, the 500 smallholder cashew farmers were used as the total population of the study. Out of this number, the total sample size was estimated using the formula proposed by Yamane, 1971. The sample size (n) is given as

$$n = N/1 + N(e)^2,$$

Where *n* is the sample size, N is the total population of the study and e is the error margin.

The total population was estimated as 500 cashew smallholder cashew farmers while the error margin of 0.05 was chosen based on the confidence level of 95%. The sample size for the study was estimated from the formula given as:

$$n = N/1 + N(e)^2$$

In this case, N= 500, and e= 0.05 hence:

$$\text{Sample size (n)} = 500/1 + 500(0.05)^2$$

$$\text{Sample size (n)} = 222.$$

Therefore, about 222 respondents who are all small holder farmers in the cashew industry participated in the study.

3.6 Sampling Procedure

The multistage sampling method was utilized to select the final respondents for the study. The multi stage sampling techniques involve several sampling methods employed at each stage of the section. It is appropriate when the respondents are widely spread over a large geographical area (Creswell, 2014).

In the first stage, the purposive sampling method was used to select the Jaman North and Jaman South districts for the study due to the predominant production of cashew in the districts.

In the second stage, the simple random sampling method was used to select three communities from each of the districts. These communities included Kokoa, Kabile, and Suma–Ahenkro in Jaman North and Faaman, Adamsu and Dwenem in Jaman South districts. The lottery method was specifically applied where communities in each of the districts were written on pieces of papers, folded and thoroughly mixed in a container. The folded papers with the names of the communities were then randomly picked to form the sample for the study.

Finally, the simple random sampling was again used to select the final respondents from the six communities in the two districts. The list of smallholder cashew farmers in the selected six communities were obtained from the Olam Cashew Buyers Company in the Jaman south and Jaman North Districts. This list constituted the sampling frame for the study. With this list, the smallholder farmers who formed the final respondents of the study were selected randomly from the list given and they were contacted through phone calls and personal visit to seek for their consent in

order to participate in the study. All those who accepted to take part of the study were visited and administered with the questionnaire of the study. In all two consecutive weeks were used to deliver the questionnaires to participants and also collected the answered questionnaire. During the data collection period, the 222 respondents who were administered with the questionnaires returned their answered questions giving a response rate of 100%.

3.7 Research Instrument

The study employed questionnaire as the main research instrument. The semi-structured questionnaire was specifically used for the data collection as the main research instruments. The semi-structured questionnaires consisted both closed and open-ended questions in the same questionnaires. The primary data was collected in line of the research questions and objectives of the study. According to Creswell (2014), the use of questionnaires promises a wide coverage unlike other tools such as interview. The researcher administered about 222 to respondents who participated in the study.

3.8 Data Analysis

The data from the study was collected, screened and validated. The data was later coded into SPSS version 18.0 software for further analysis. The Cobb-Douglas production function was esteemed through OLS regression. The regression model used for the study has been discussed below.

3.9 Profitability Analysis

In estimating the Profitability of cashew production by the stallholder cashew farmers based on the production output during the 2019 cashew growing seasons, the gross margin analysis was estimated. The Gross margin is the difference between total

revenue (TR) and the total variable cost (TVC). The fixed cost is usually negligible in cashew production hence treated as such.

The formula is given as:

$$GM=TR-TVC \quad (5)$$

Where;

GM =Gross margin

$$TR = \text{Total Revenue} =P.Q \text{ (P=Price, Q=Quantity)} \quad (6)$$

$$TVC= \text{Total variable cost} \quad (7)$$

Further, the factors determining the profitability of the cashew farming was estimated using the regression model in the equation (8).

$$GM =\alpha + \beta_1\log X_1 + \beta_2\log X_2 + \beta_3\log X_3 + \beta_4 \log X_4 + \beta_5\log X_5+ \beta_6 \log X_6 + \beta_7\log X_7 + \beta_8 \log X_8 + \beta_9 \log X_9 +U \quad (9).$$

Where

GM= Gross margin

X1=farm size (ha)

X2=value of land (Ghana Cedis)

X3=price of cashew (Ghana cedis)

X4=Labour in man days

X5=Gender (male=1, female=0)

X6=Age (years)

X7=Educational level (years)

X8=Farming experience (years)

X9=Family size (hectars)

U=Error term

(β 's) = the coefficients

This model was estimated using the multiple regression model

3.10 Chapter Summary

The chapter three presented the various techniques and research design for the study. The chapter discussed the study area, the research design and the type of Data used. Similarly, the research instrument used in the study was discussed in this chapter. The chapter three also highlighted on the various techniques used in sampling and data collection. Furthermore, data analysis techniques based on the theoretical framework were presented in the chapter. Finally, the ethical issues considered in the study were highlighted in the chapter.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

The study aimed at investigating the determinants of productivity and profitability of small holder cashew farmers in the Bono region of Ghana. The study specifically sought to achieve the following objectives:

1. To examine the determinants of cashew production in the Bono Region.
2. To identify the elasticity and productivity level of cashew production in the Bono Region.
3. To estimate the profitability of the cashew production in the Bono Region.
4. To identify the determinants of profitability of the cashew production in the Bono Region.

In order to address these research objectives, 222 smallholder farmers who are into cashew farming were contacted to form the key respondents of the study. The respondents were selected from two main districts namely the Jaman South and Jaman North Districts which are known as key areas of Cashew production in the Bono region. The descriptive statistics of the demographic characteristics of the respondents and their farms are described in Table 4.1a and 4.1b

4.1 Socio-Economic Characteristics of Respondents

Results from Table 4.1a show that the 178 of the respondents representing 80.2% while 44 of the respondents were females representing 19.8%. Further, the results from Table 4.1a reveal that, 41.9% of the respondents did not have formal education while 29.3% of the respondents had primary education as their highest level of education. Similarly, 17.1% of the respondents had secondary education while 11.7%

had tertiary education. Moreover, the results indicate that, about 43.7% of the respondents were farmer owners who operated their own farms while 33.3% comprised caretakers of the cashew farms. Likewise, the results suggest that 23% of the respondents were share croppers (see Table 4.1b).

Table 4.1: Demographic Features of Respondents

Variables	Frequency	Percentage (%)
Sex		
Male	178	80.2
Female	44	19.8
Educational Background		
Non-formal education	93	41.9
Primary Education	65	29.3
Secondary Education	38	17.1
Tertiary education	26	11.71
Farm Ownership Type		
Farmer Owner	97	43.7
Caretaker	74	33.3
Share Cropper	51	23.0
Total	222	100.0

Source: Field Survey, 2020

Results from Table 4.1b show that, the average age of the respondents who were farmers was 49 years while the maximum age was 70 years and the minimum age was 28 years. The findings from Table 4.1b also indicate that, majority of the framers have average household size of 6 persons with minimum of 2 and a maximum number of 14 persons.

Based on the farming experience of the farmers, the results show that, the average number of years of farming experience of the respondents was 7.6years while the maximum number of years of farming experience stood at 24 years and the minimum

was 2years. Again, the average age of farm was 10 years even though the oldest farm was 27 years while the youngest farm was 5years (See Table 4.1b).

Table 4.1b: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness
Farmer and Farm characteristics							
Age of farmer	222	28	70	49.041	7.775	60.446	-0.030
Household size	222	2	14	6.707	2.513	6.317	0.239
Farming experience	222	4	24	7.635	3.441	11.844	2.320
Farm age	222	5	27	10.356	3.526	12.429	0.556
Factors of Production							
Fertilizer	222	2	16	4.874	2.586	6.690	1.827
Farm size	222	2	25	10.302	3.576	12.791	0.914
Labour	222	2	200	11.793	14.929	222.871	10.212
Extension Visits	196	0	6	2.520	0.974	0.948	0.716
physical capital	222	40	4000	702.032	364.437	132814.682	5.553
Output, Revenue and Cost							
Output	222	1	35	7.480	3.300	10.892	3.792
Price	222	300	700	473.198	72.231	5217.327	0.404
Total Revenue	222	600	17500	3520.045	1610.645	2594177.826	3.818
Gross Margin	222	-250	17230	2825.320	1661.903	2761922.472	3.821
Total Variable cost	222	120	2750	694.725	248.001	61504.580	2.482

Source: Field Survey, 2020

The results from Table 4.1b reveal that, farmers use fertilizers and other chemicals for their agronomic practices. The average bags of fertilizers used was 4.8. The results show that the maximum quantity of bags of fertilizers used was 16 while a minimum of 2 bags were used. The findings from the study show that, average labour measured in man days was 11.8 while the maximum of 200 and the minimum was 2.

Moreover, extension services are required in the production of cashew in the study area. In the study, the number of extension officers visit to farms were considered for the analysis. The results reveal the average number of extension officers' visits to farms was 3 days per growing season while some farmers did not have the opportunity to obtain extension services at all. The average farm size was 10.3 hectares while the maximum farm size was 25 hectares and the minimum was 2 hectares.

Again, the average expenditure on physical capital employed during the growing season was GHC702.00. The average output from the cashew production during the 2019 growing season was 7.4 bags where maximum yield was 35 bags and the minimum was 1 bag of cashew nuts. The average price per bag of cashew nut in the Jaman districts differs from community to community. The results show that the average price per bag was GHC473.0 while average revenue obtained was GHC3,520. The average cost of variable inputs was GHC694 and average gross margin of GHC2825 was obtained (See Table 4.1b).

4.2 Determinants of Cashew production

The study examined the determinants of cashew production by small holder farmers. The OLS regression analysis was employed to estimate the Cobb-Douglas production function. The double-log function was used to achieve a standardized number of variables measurement, efficient estimates and minimal standard errors. Results from the estimate of the production function are presented in Table 4.2. Findings from Table 4.2 reveals an R-squared value of 0.54 which implies that, about 54% of the variation in the dependent variable (Cashew output) is explained by the model.

Similarly, the F-statistics which measures the joint significant effect of the model on the cashew output productivity is statistically significant at 1% level of significance.

The results from the study unveil that, variables such as price of cashew nut, Extension services, Labour, Farm age, Farm size, Household size, physical capital, and Fertilizer have statistically significant and positive impact on output productivity.

The results from Table 4.2 show that price of cashew nut ($\beta=0.154$, $P<0.10$) has statistically significant influence on the output productivity of cashew nut production in the study area among small holder farmers. The results imply that, a unit increase in price of the cashew nut produce increases the cashew output produced by 0.154 units. This confirms that, a satisfactory price for the smallholder cashew farmers motivates the farmers to increase their output, expand their revenue and profit. Increasing purchasing price for the cashew farmers keep the small holder cashew farmers in the industry while unstable prices for the farmers may contribute to a decrease in cashew productivity.

Table 4.2 indicates that, Extension services ($\beta=0.1489$, $P<0.05$) contributes positively and significantly to cashew nut output produced in the study area. The results demonstrate that, a day increase in number of extension officers' visit to cashew farmers increase cashew output produced by 0.149 units and this was statistically significant at 5% level of significance. The agriculture extension officers provide cashew farmers with information on adoption of new technology, market information to strengthen the competency of the small holder farmer to increase production. The extension services equip farmers with the needed skills, innovations and technology to improve their performances. The findings are in line with previous authors who investigated the key factors that influence cashew farm productivity. The findings

agree with Nhantumbo, Takeshita, Uaciquete, & Miura (2017) who established that extension officers have a vital positive role to play in the cashew production. Findings from Anik, & Salam, (2014) suggest that extension officers have positive impacts on cashew output such that, the more the farmers have access to extension farmers, the greater their outputs. These extension agents support the farmers with effective knowledge, skills, innovation and technology. Access to extension services results in increase productivity. However, it is evident that, farmers who do not have adequate access to extension services produce less output or remain less productive.

Findings from Table 4.2 suggest that, Labour ($\beta=0.1923$, $P<0.01$) has statistically significant positive impact on cashew output productivity among the smallholder farmers. The results imply that, 1% increase in labour increases output productivity by 0.192%. This means that, labour availability and easy access to labour by small holder farmers contributes to increase output of cashew nuts.

Furthermore, Table 4.2 shows that, farm Age ($\beta=.2260269$, $P<0.01$) has statistically significant positive impact on cashew output productivity. The results indicate that, a year increase in farm age increases farm output by 0.226 units. Even though, the very old farms turn to record low output due to the old aged cashew trees and loss of soil productivity.

Results from Table 4.2 show that, Farm size ($\beta=.0187325$, $P<0.05$) has statistically significant positive influence on output productivity from cashew production. This implies that, increase in farm size increases output while a reduction in farm size also reduces output of cashew among small holder farmers. This implies that 1% increase in farm size increases the output productivity by 0.0187%. Similarly, the results show that, Household size ($\beta=0.1295$, $P<0.05$) has statistically significant positive influence

on output of cashew from small holder farmers. The results show that, 1% increase in household size of farmers increases output by 0.1295%. The plausible reason is that, among smallholder farmers, family labour play a key role in their farming business. They rely much on family labour hence as their household size increase, they get access to more labour to help in the farming business

The findings are not different from previous studies which confirm that access to labour, farm age and farm size have significant influence on cashew output productivity. This is because poor access to labour limit the quantity of cashew output produced and the size of acreage farmed (Evans, Mariwah & Antwi 2015). Cashew production involve more of manual labour effort which makes labour more relevant in determining the output productivity of the cashew industry.

The findings from this study are in line with previous studies by Peprah, Amoako, Adjei & Abalo, (2018) and Boafo, Appiah, & Tindan (2019) who concluded that poor smallholder farmers do not have access to labour, they rely on their own effort, family support and sometimes child labour which do not allow them to expand their sizes of farms. This confirms that, smallholder farmers' productivity is significantly influenced by labour availability as key factor of production.

Table 4.2 reveals that capital ($\beta=0.175$, $P<0.05$) has a significant positive influence on cashew output productivity. The results show that, 1% increase in physical capital increase output by 0.175 % and the vice versa. Physical capital contributes to increasing output productivity among smallholder farmers in the cashew production industry. The findings agree with that of Uwagboe, Adeogun and Odebode (2010), and Frimpong (2016) who highlighted the important role of capital in the cashew production industry. Access to capital helps to farmer to obtain some inputs and other

factors of production to improve their productivity. However, the smallholder farmers do not have access to enough capital such as credit facilities, money lenders, bank loans and hence rely on family members and personal savings to generate small capital for their farming activities (Frimpong, 2016). Corroborated by this, Uwagboe, Adeogun & Odebode (2010) concluded that lack of adequate capital among stallholder farmers has negative impact of the cashew production. Again, one of the main farm inputs in the cashew production is fertilizer. The results from Table 4.2 show that Fertilizer ($\beta=0.138$, $P<0.05$) application in the cashew farm has significantly positive impact on cashew output productivity among the small holder farmers. The results imply that, 1% increase in fertilizer applied in the cashew farm increase output productivity by 0.138%.

However, the results from Table 4.2 show that, farmer age ($\beta=-0.4222$, $P>0.05$) has negative statistically significant influence on cashew output productivity. Increase in farmers age reduces their productivity and the vice versa. This simply means that, the old cashew farmers tend to have less cashew output than their young small holder counterpart farmers (see Table 4.2).

The findings confirm that of previous studies such as Wongnaa (2013), who investigated the factors influencing cashew output productivity. The finding from Wongnaa (2013), further demonstrated that, farm size, education background, access to extension services, fertilizers and pesticides have positive impact on cashew output in the study area. These factors account for the productivity of cashew among small holder farmers.

Table 4.2: Estimates of the Production Function Analysis.

Variables	B	Std Error	T	P value
Logprice	.1541934*	.0840888	1.83	0.068
Logextension	.1489949 **	.0638808	2.33	0.021
Loglabour	.1923344***	.0589899	3.26	0.001
Logfarmage	.2260269***	.0683688	3.31	0.001
Logfarmsize	.0187325***	.0754938	0.25	0.804
Logsex	-.1041337	.074756	-1.39	0.165
Logage	-.4222042***	.165267	-2.55	0.011
Logedu	.0625885	.0419594	1.49	0.138
Loghhs	.1295191**	.0578467	2.24	0.026
Logownership	.3522607	.2298295	1.53	0.127
Logcapital	.175348 **	.0752396	2.33	0.021
Logfertilizer	.1380459 **		2.61	0.010
Intercept	4.429135 ***	.9460167	4.68	0.000
F (12, 183)	4.830	Prob>F	0.000	
R-Squared	.5404			

Note: *, ** and *** denote 10%, 5% and 1% levels of significance respectively.

Source: Field Survey, 2020

The study further analysed the influence of the socio-economic factors on cashew out productivity by estimating the cobb-Douglas production with based on Robust regression analysis. The robust regression was conducted to confirm the results obtained in Table 4.2 based on the influence of the socio-economic factors on cashew output productivity. Table 4.3 presents the results on robust estimates and robust standard errors from the regression. The results from the robust regression confirm the OLS regression results presented and interpreted in Table 4.3. The results from the robust analysis in Table 4.3 confirm that, price of cashew nut, Extension services, Labour, Farm age, Farm size, Household size, physical capital and Fertilizer have statistically significant and positive impact on output productivity. The results from

the robust regression was not different hence the study confirm that, the estimates obtained from the analysis of the production function was appropriate.

Table 4.3: Estimates of the Production Function Analysis (Robust analysis)

Variables	B	Robust Std Error	T	P value
Logprice	.1541934	.0989943	1.56	0.121
Logextension	.1489949 ***	.0522286	2.85	0.005
Loglabour	.1923344*	.1044976	1.84	0.067
Logfarmage	.2260269 **	.1016702	2.22	0.027
Logfarmsize	.0187325	.104811	0.18	0.858
Logsex	-.1041337	.0727328	-1.43	0.154
Logage	-.4222042 **	.1962526	-2.15	0.033
Logedu	.0625885	.0388017	1.61	0.108
Loghhs	.1295191 **	.0588407	2.20	0.029
Logownership	.3522607	.2720304	1.29	0.197
Logcapital	.1753485*	.0910038	1.93	0.056
Logfertilizer	.1380459 *	.0815375	1.69	0.092
Intercept	4.429135***	1.281045	3.46	0.001
F (12, 183)	3.05	Prob>F	0.0006	
R-Squared	0.5404			

Note: *, ** and *** denote 10%, 5% and 1% levels of significance respectively.

Source: Field Survey, 2020

4.3 Production Elasticity and Productivity Level (Return to scale)

The study examined the input elasticities of the cashew nut production and the level of productivity. Based on this, the elasticities of the key factors of production such as labour, farm size, physical capital, and fertilizer were identified. The results show that, the various inputs used in the cashew production are inelastic. Results from table 4.4 show that, Labour, farm size, physical capital and fertilizer have elasticity coefficients of 0.192, 0.0187, 0.175 and 0.138 respectively. However, the results

imply that, labour has a greater elasticity coefficient hence labour account for major input factors in cashew production.

The positive elasticity coefficients of the input factors indicate that, the factors have positive returns to scale in cashew production and therefore contribute to productivity of the cashew nut. It simply means that, the cashew farmers efficiently use their production inputs in the cashew farms. The positive Return to Scale (RTS) indicate that, the small holder farmers are producing at a rational stage of production and any additional inputs combination increase output correspondingly. The returns to scale value of 0.52443 implies that, a unit increase in the combination of the inputs increases the overall output productivity by 0.52443 units (See Table 4.4). The results suggest that the small holder cashew farmers are producing at a stage where any additional input support increases the cashew output produced in the study area. The findings are in line with Wongnaa and Awunyo-Vitor (2013) and Evans, Mariwah and Antwi (2015) who argue that small holder farmers are effective in output combinations in Ghana. They also concluded that, smallholder cashew farmers are rational producers and are productive.

Table 4.4: Production Elasticity and Return to Scale

Variable	Elasticities
Loglabour	.1923344
Logfarmsize	.0187325
Log capital	.175348
Logfertilizer	.1380459
Return to Scale (RTS)	0.52443

Source: Field Survey, 2020

Table 4.5: Results from Link Test on Model Specification

Statistics	B	Std Error	T	P values
Hat	2.207753	1.702808	1.30	0.196
Hatsq	-.3074332	.432227	-0.71	0.478
intercept	-1.176233	1.67234	-0.70	0.483
R-squared	0.5345			

Source: Field Survey, 2020

4.4 Multicollinearity Test

The multicollinearity test was meant to check if the independent variables in the regression model were highly correlated or not. To follow the rules of OLS regression, if the variables are highly correlated, it possesses the problem of colinearity which makes the estimates not efficient or not robust. In order to check the problem of colinearity in the model, Gujarati (2007) proposes a test using Variance inflation factors (VIF). Variables with VIF values more than 10 implies the presence of multicollinearity. The results from Table 4.5 shows that, the VIF values of the variables are minimal and are less than 10. Hence multicollinearity is not a problem in the model.

Table 4.6: Results from Multicolinearity Test

Variables	VIF	1/VIF
Logprice	1.07	0.931305
Logextension	1.13	0.883187
Loglabour	1.14	0.876920
Logfarmage	1.27	0.785330
Logfarmsize	1.29	0.773885
Logsex	1.22	0.817208
Logage	1.18	0.847935
Logedu	1.13	0.881098
Loghhs	1.18	0.845248
Logownership	1.17	0.851562
Logcapital	1.26	0.793187
Logfertilizer	1.11	0.898342
Mean VIF	1.18	

4.5 Heteroscedasticity Test

The study examined the heteroscedasticity problem associated with cross-sectional data in OLS regression. One of the important assumptions of OLS linear multiple regression is constant variance. If this assumption is violated, the implication is that the coefficient estimated cannot be efficient, reliable and robust. Therefore, in this study, the Breusch-Pagan / Cook-Weisberg test for heteroscedasticity was utilized using stata computer software. The results reveal that, the null hypothesis of constant variance was not rejected. This means that, the regression model used for the analysis had constant variance hence appropriate to yield best liner unbiased estimates.

Table 4.7: Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Statistics	2.09
chi2(1)	0.1485
Prob > chi2	

Source: Filed Survey, 2020

4.6 Profitability Analysis of the Cashew Production

The study examined the profitability of cashew production among small holder farmers in the study area. Results from Table 4.8 show that. Average variables cost of producing cashew per hectare is GHC694 while some small holder farmers spent a minimum of GHC120.00 and a maximum of GHC2750. The average total revenue of respondents obtained from the production of cashew per hectare is GHC3520.00 with minimum total revenue of GHC600 and maximum revenue of GHC17500.00. This implies that, the total revenue obtained from the cashew production exceed the total variable cost incurred in the production process.

Table 4.8 also show that, the gross margin which measures the difference between cost of production and revenue by the smallholder farmers was positive. This represent the profit obtained from the production of cashew nut by the small holder farmers. The results from Table 4.8 indicate that, an average gross margin or profit obtained by the respondents was GHC2825.319. This implies that, cashew production among the stallholder farmers is profitable. The findings support that of Wongnaa and Awunyo-Vitor (2013) who examined the socio-economic characteristics of smallholder cashew farmers and the profitability of cashew production in Ghana. They also concluded that, cashew production in Ghana is more profitable venture. Many farmers can take the opportunity to venture into cashew production due to it being profitable.

Table 4.8: Profitability Analysis

Variables	N	Minimum	Maximum	Mean	Std. Deviation	Skewness
Total Cost (GHC)	222	120.000	2750.000	694.725	248.001	2.482
Total Revenue	222	600.000	17500.000	3520.045	1610.645	3.818
Total Margin (Profit)	222	-250.000	17230.000	2825.319	1661.903	3.821

Source: Field 2020

4.7 Factors influencing Profitability in Cashew Farming among Smallholder

Farmers

In line with the research objectives, the study investigated the key factors that determine the profitability level of small holder cashew farmers in the study area. Findings from the study reveal that, amount of cashew output produced, extension services, price of cashew, and farm size are key determinants of profitability from cashew production. The double log linear regression model was further used where the important assumptions underlying the OLS analysis were checked and met for the model to be used. The R-square for the profitability model reveal a numerical value of 0.8024 which implies that about 80% of the model explains the variations in the dependent variables gross margin or profitability value.

Table 4.9 shows that, the quantity of cashew nut produced significantly determine the farmer's profitability in cashew production all other thing being equal. The results suggest that farmer output ($\beta=0.1306175$, $P>0.01$) has a statistically significant positive influence on profitability of the small holder farmers in cashew production. The coefficient implies that 1% increase in the farmer output increases their profit by 0.13%. The findings unveils that, increase in output obviously increase farmer profitability in the cashew industry. This implies that, any policy to increase farmer profitability should be directed towards increasing output.

Increasing price of cashew also has a direct positive impact on the profitability of the small holder cashew farmers. The results from Table 4.9 indicate that, price of cashew ($\beta=1.557603$, $P>0.01$) also play a key role to determine the profitability of the farmers. The results show that, 1% increase in price of cashew increases the

profitability by 1.557 % and the vice versa. This implies that improving the price for cashew contributes to farmer profitability in the cashew industry.

Table 4.9 again reveal that, extension services ($\beta=0.152863$, $P>0.01$) contribute positively and significantly to smallholder farmer profitability. The results suggest that, 1% increase in the number of visits by agriculture extension agents' visit to small holder farmers contributes 0.153 1% in the profit accrued to small holder farmers. Table 4.7 also show that, factors such as farm size ($\beta=.1579697$, $P>0.01$), and farm age ($\beta=-0.1226$, $P>0.01$) also account for the profitability of the cashew farmers. The results show that farm size has positive and significant influence on profitability however, farm age has a negative and significant influence on farmers' profitability level (see Table 4.9).

The findings from the analysis support that of previous studies such Wongnaa and Awunyo-Vitor (2013) found that, factors such as extension services, output produced, pricing of cashew nut, and farm size are predominant determinants of profitability of cashew farming ventures. Similarly, Evans, Mariwah and Antwi (2015) confirm that low pricing for cashew nut produced reduces the profitability of in the cashew industry particularly among smallholder farmers. Likewise, Peprah *et al.*, (2018) who found that in most cases, since the farmers are not able to store the cashew harvested, they tend to sell their cashew nuts produced at very cheap prices. This makes the famer worse-off, their incomes are not improved and their living conditions worsened. Therefore to improve the profitability of the small holder cashew farmers the pricing, extension services and output must be improved.

Table 4.9: Determinants of Cashew Farm Profitability

Variables	B	Std Error	T	P value
Logoutput	.1306175 ***	.0067999	19.21	0.000
LogFarm age	-.1226197*	.064721	-1.89	0.060
LogExtension	.152863 ***	.05539	2.76	0.006
Logedu	-.0155463	.0360117	-0.43	0.666
Log price	1.557603 ***	.0766694	20.32	0.000
Logfarmsize	.1579697 **	.0633105	2.50	0.013
Constant	-.9936164	.9445313	-1.05	0.294
R-squared	0.8024			
Adjusted R-Square	0.7928			
F	83.04	F>0.05	0.0000	

Source: Filed Survey, 2020.

Further, the robust regression was utilized to estimate the determinants of the cashew farm profitability among the smallholder farmers. The results from the robust analysis are presented in table 4.10. The results from Table 4.10 confirm that output, extension service, and price of cashew have more statistically significance positive impact on cashew farm profitability among the smallholder cashew farmers.

Table 4.10: Determinants of Cashew Farm Profitability (robust regression)

	Coef.	Std. Err.	Robust t	P> t
logexpoutput	.5569804***	.1137719	4.90	0.000
logextension	.1189004 *	.070534	1.69	0.094
logfarmsize	.1317937	.1011918	1.30	0.194
logedu	-.0676583	.0571356	-1.18	0.238
logprice	1.326008 ***	.1411354	9.40	0.000
logfarmage	.0582335	.1321283	0.44	0.660
_cons	-1.291617	.9813602	-1.32	0.190
R ²	0.4686			
Prob > F	0.0000			
F(6, 186)	23.16			
Root MSE	.44551			

Note: *, ** and *** denote 10%, 5% and 1% levels of significance respectively.

Source: Field Survey, 2020

4.8 Chapter Summary

The chapter presents the results and discussion of the findings emanating from the study based on research objectives. In this chapter, the descriptive statistics of the socio demographic characteristics of respondents have been presented. The data analysis was performed by stata computing software version 18.0. The descriptive statistics of the variables used in the regression model have been presented in this chapter.

The chapter again presents estimate of the determinants of cashew farm output based on Cobb-Douglas production function estimated through double log multiple linear regression model. The OLS assumptions on heteroscedasticity, model specification and multicollinearity have been tested in the chapter to confirm the suitability of applying the OLS to the data used.

Results on elasticity and returns to scale of the cashew production among the smallholder farmers have been presented in the chapter. The result on profitability analysis has been presented in the chapter based on the research objectives. The outcome contributes to policy and practice in the cashew production industry in Ghana.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The examined the factors that determines the productivity and profitability of smallholder cashew farmers in the Bono region of Ghana. A total respondents of 222 smallholder farmers participated in the study. The data was collected through the use of questionnaires as the key instruments during the study. The data collected were coded and analysed using Stata version 18.0 as the main statistical computing software for the study. The study explore among other things the following specific research objectives:

- i. To examine the determinants of cashew production in the Bono Region.
- ii. To identify the elasticity and productivity level of cashew production in the Bono Region.
- iii. To estimate the profitability of the cashew production in the Bono Region.
- iv. To identify the determinants of profitability of the cashew production in the Bono Region.

Based on these research objectives, the data analyses were and results discussed. The subsequent section presents the summary of findings from the study in line with the various research objectives.

5.1 Summary of Findings

In line with research objective 1, the results reveal that, some socio-economic and farmers characteristics are the predominant determinants of cashew farming productivity. The Cobb-Douglas production function was estimated through OLS after the important assumption behind OLS were checked and corrected. The double log linear multiple regression model was used for the estimation of the coefficients. The findings suggest that, variables such as price of cashew nut, Extension services, Labour, Farm age, Farm size, Household size, physical capital, and Fertilizer have statistically significant positive impact on output productivity among small holder cashew farmers in the cashew industry. This implies that improvement in any of these factors contribute to increasing the production output of the cashew farming among small holder farmers. Among these factors, age of farm had the greatest influence the cashew farm output productivity in the study. However, farmer age, and sex of farmer were also found to have negative influence on the output productivity of the cashew farmers.

Further, to address the objective 2, identified the elasticity and return to scale in the cashew production using the estimates from the regression analysis results on production function analysis. The results show that, the elasticity of the farm production inputs factors measured by the regression coefficients were inelastic as the individual coefficients were less than unity. Similarly, the results show that, the smallholder farmers produced at a rational stage of production such that any addition to the inputs combination increases the output produced. The findings show a positive returns to scale suggesting that smallholder cashew farmers' effective producers.

Moreover, the findings in line with research objective 3 reveal the profitability of cashew production venture among smallholder farmers in the study area. The results indicate a positive profit value for the cashew nut production among the smallholder farmers. This means that, the cashew production among the smallholder farmers are profitable.

Finally, the study in line with research objectives 4 established the key factors that determine the profitability of cashew production among the small holder farmers in the study area. The results show that, quantity of cashew nuts output produced, extension services, price of cashew, and farm size are key determinants of profitability from cashew production.

5.2 Conclusions

Findings from the study demonstrate that, farm size, extension services, and physical capital constitute the predominant factors that contribute to smallholder cashew farmer productivity. Improvement in farm sizes, and intensification of extension agents visits to these small holder has a greater potential to increase their productivity. Household sizes, labour availability and access to fertilizer also contribute to improvement in the productivity of the cashew production among smallholder farmers.

What is more, the findings suggest that, smallholder cashew farmers produce at a rational stage with efficient input combinations. The positive return to scale value less than one implies that, any additional increase in factor inputs will increases output produced. Their factor inputs combined are inelastic as the coefficient is less than unity.

Based on the findings from the study, it can be concluded that, the cashew production among smallholder farmers is a profitable venture. As the difference between the revenue and the total variable cost remain positive, there is hope that smallholder farmers on the average accrue a supernormal profit from their farming ventures.

The findings from the study suggest that factors such as pricing of cashew nuts, access to extension services and farm size have positive influence on profitability of the farmers. Farmers who have access to extension services are able to improve their profitability. Similarly, those farmers that expand the acreage of their production are able to increase their profit while good pricing for the cashew nuts also contribute to the profitability levels of the farmers.

5.3 Recommendation

Based on the conclusions from the study, the following recommendations are made:

Firstly, the study concluded that, productivity is significantly influence by extension visits, hence it is recommended that, the ministry of food and agriculture (MOFA) unit in the Bono region should intensify the agriculture extension services in the cashew production industry. The extension officers should increase the number of visits to the smallholder farmers so that they can educate the farmers on market information, adoption of new technologies to improve their output productivity. Private extension officers may provide services to the small holder cashew farmers at a minimized fee so that accessibility to extension services among the smallholder farmers can be improved.

The findings from the study suggest that fertilizer application play a key role in the productivity of the smallholder cashew farmer's productivity. Therefore, the study recommends that, the smallholders should be given enough fertilizers at a subsidized

cost to be able to improve their production outputs. Cashew buyers and other NGOs such as Adventists Development and Relief Services (ADRA), Technoserves, the United States Agency for International Development (USAID), and the German Development Agency (GIZ) can supply the smallholder cashew farmers with fertilizers for free or at a very subsidized fee.

Again, the government program of planting for food and jobs under the ministry of food and agriculture should consider the cashew farming as priority areas so that more attention can be given to the cashew industry players such as the smallholder farmers.

Labour availability has been identified to have significant impact on cashew farm productivity, therefore policies to improve cashew production should focus on providing labour for the smallholder cashew farmers at a subsidized cost or for free. This will motivate the smallholder farmers to increase their production.

The findings demonstrate that the smallholder farmers were producing at a rational stage of production where any increase in inputs combination results in increased output. Hence development partners, cashew buyers and MoFA should supply the required inputs to the smallholder farmers to improve their production and their profitability levels.

The findings reveal that pricing of the cashew nut was an issue which affect the profitability in the production of cashew by the smallholders. The results from the study reveal that different prices are given by different buyers in the study area unlike cocoa which has a fixed price for all buyers. It is therefore recommended that the government, ministry of food and agriculture should fix the price for cashew just like that of cocoa. This will help the smallholder farmers to improve their profitability and productivity.

5.4 Limitations of the Study

The study was limited to only small holder farmers while those into large scale cashew production were not considered. Even though the cashew production is dominated by the small holder farmers in this study area, there are other large-scale cashew farmers who contribute to the output levels of cashew nut produced on the area.

Again, the study utilized only a cross sectional data instead of time series of longitudinal data. Using only cross-sectional data fails to take care of changes in the variables over time. Some of the variable used in the study are dynamic which changes over time where their effect also changes with time. Considering these variables which are time variant could have broadened the empirical understanding of the factors that accounts for the cashew production output, profitability and returns to scale.

Again, the study used sample size of 222 respondents who were only farmers. Even though the sample truly represented the true population, increasing the sample size could have given additional highlight to the empirical findings of the study.

In spite of these limitations, the quality of results from the study were not significantly affected since adequate measures were employed to mitigate against these limited such that they did not render the results invalid.

5.5 Areas of Further Research

The study was limited to only small holder farmers while those into large scale cashew production were not considered. Future studies my focus on comparative analyses of the factors influencing cashew productivity between smallholder farmers and large-scale producers. Again, longitudinal data may be collected to investigate the

determinants of productivity of cashew producers instead of cross-sectional data. This will help to identify the changes in these factors over time so that sustainable policies to improve determinants of cashew productivity and profitability among smallholders' farmers can be successfully designed.

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APPENDIX

Questionnaires for Respondents

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF ECONOMICS

This questionnaire is a research instrument, which seeks to solicit your views on **Economic assessment of determinants of smallholder cashew farmers' productivity and profitability in the bono region of Ghana**. You have been provided with series of questions and statements with options. Please, kindly spend some 20 minutes to respond to the items by ticking (✓) the option that you consider most appropriate. You are assured of confidentiality and strict secrecy and your identity will remain anonymous.

DEMOGRAPHIC FEATURE OF RESPONDENTS

1. Sex

Male () Female ()

2. What is your Age?

3. What is your highest level of education?

4. What is your household size?

5. What is your marital status?

Single () married () divorced () separated () cohabitation () never married ()

6. What is the major sources of income?

Farming () others ()

7. Would you please indicate the type of farmer?

Farm owner () care taker () share cropper ()

PRODUCTION

8. Would you please give us information on area, labour age and output of your cashew farm in 2019 growing season?

Age of Cashew farm (year)	Area (ha)	Labour employed(in man days)	Expected output (kg, bag)	Actual output (kg, bag)	Cost of cashew nut per bag (000GHS)	Cost of labour for 2019 crop season

9. How long have you been in cashew production? (years)

10. Do you use any fertilizers and agrochemical to improve the cashew crop?

() Yes () No

If *No*, why? _____

If *Yes*, list all the fertilizers and agrochemicals in accordance with the following

Agrochemicals	Name or Formula	Amount (Kilo or Litter per Hectare)	Time (per Month)	Cost (in GHS)
Organic nutrients				
Chemical nutrients				
Herbicide				
Fungicide				
Others				

11 How much did you spend on planting, harvesting and selling cashew nut in 2019 entire growing season?

No	Cost items	Amount (000 GHS)
1	Fertilizer/Pesticide	
2	Weeding	
3	Harvest	
4	Preservation, storage	
5	Drying	
6	Others (specify)	
	Total	

12. Complete the following table in accordance with the cashew production, which was sold in 2019

Product	Amount (Kg)	Price per bag
Cashew nut		
Cashew apple		
Cashew apple + nut		

13. Do you receive actually any kind of technical support from extension officers ()
Yes () No

14. How many times did the extension officer visit your farm during 2019 farm season?.....

End of questionnaire