

UNIVERSITY OF GHANA

**CONTRIBUTION OF VALUE ADDITION IN AGRICULTURE TO
DEVELOPMENT: CASE OF THE OIL PALM INDUSTRY IN KWAEBIBIREM
DISTRICT, GHANA**

BY

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DECLARATION

I, Rebecca Sarku declare that, this research and its entire contents represent my own work. I remain answerable to every question pertaining to this work and duly acknowledged all secondary sources in the list of references. The research is presented to the University of Ghana Graduate School through the Department of Geography and Resource Development in partial fulfilment of the award of Master of Philosophy Degree. No part whatsoever has been presented to any other institution for the ward of degree.

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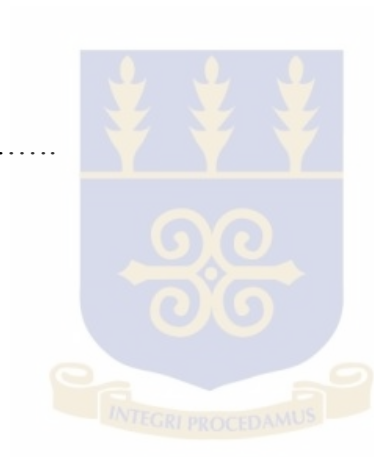
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DEDICATION

This study is dedicated to God almighty for his grace throughout the study period

I also dedicate this study to my family (Daddy, Mummy, Edem, Cecilia and Innocent).

Thank you for supporting my education.



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ABSTRACT

This study examined the contribution of value addition in agriculture to socio-economic development with reference to the oil palm industry in Kwaebibirem District. The specific objectives addressed in this study were to: determine the character of the activities that generate value in the oil palm industry; find how the process of value addition contributes to development, especially in terms of employment and income; and analyse the wider policy implications for agricultural development.

The study was based on information generated from field work conducted in five communities in the Kwaebibirem District. Quantitative and qualitative methods were used to elicit data for the study. For qualitative method, interviews, focus group discussions, and observation were used to derive information from actors in the oil palm value chain. Quantitative method involved the use of questionnaire to generate information from 110 oil palm processors. Statistical Package for Social Scientists (SPSS) version 20.0 was used to generate descriptive statistics, test for correlation, conduct ANOVA test and multiple regression analyses. The Net-Profit approach is also used to analyse the average income generated by processors.

Result shows that value addition activities are undertaken from the Oil Palm Research Institute (OPRI) to the final consumption of oil palm products. At OPRI, improved planting material called 'tenera' was produced in commercial quantities and supplied to farmers and nursery operators in the district. Small and large scale producers of the oil palm add value to the crop by applying fertilisers, herbicides, pesticides and other value adding materials. Harvested fruits were sold to small scale processors or large scale mills. Small scale processors add value to the palm fruit by: leaving it to ferment for some days before processing; production of different types of palm oil, namely, '*dzomi*', '*ngo paa*' and '*samina ngo*'; and the recovery of kernels from pressed palm cake and

fibers. It was realised that processing of kernel by small scale producers has been transformed from the traditional mode of winnowing, roasting, grinding and boiling of kernel paste to the use of modern equipment such as the combine digesters, 'hofers' and ovens. It was also revealed that the large scale mill owned by GOPDC has a well-built vertical chain of production whiles, the small scale sector have their production chain disconnected at various stages.

Findings from the questionnaire survey shows that the average income generated from adding value to 1 tonne of fresh fruit bunch and kernel through processing were GH¢ 375.72 (\$ 143.88) and GH¢131.64 (\$ 50.41) respectively. The benefit cost ratio of 2.17 and 1.73 for processing palm fruits and kernels respectively revealed that processing palm fruits and kernels is a profitable value addition strategy. In addition, processors employed an average number of 8-10 people to process 1 tonne of palm fruit and kernel in a small scale mill. Subsequently, the study established that whiles value addition is contributing to increase income and employment; it has also been associated with the growth of other industries in the district. The implications of this study are that value addition in agriculture has the ability to increase income, reduce: rural unemployment; underemployment; rural urban migration; rural poverty; reduce waste in agriculture productions.

TABLE OF CONTENTS

Content	Page
DECLARATION.....	i
DEDICATION.....	ii
ACKNOWLEDGEMENT.....	iii
ABSTRACT	iv
TABLE OF CONTENTS	vi
LIST OF FIGURES	xii
LIST OF ABBREVIATIONS.....	xiii
CHAPTER ONE.....	1
GENERAL BACKGROUND	1
1.1 Introduction.....	1
1.2 Problem Statement.....	2
1.3 Objectives	4
1.4 Research Hypotheses	5
1.5 Theoretical Framework.....	5
1.6 Structure of the study.....	10
CHAPTER TWO.....	12
LITERATURE REVIEW	12
2.0 Introduction.....	12
2.1 The Concept of Value Addition in Agriculture	12
2.2 Characteristics of Value Addition in Agriculture.....	13
2.3 Strategies of Value Addition in Agriculture.....	14
2.4 Socio-Economic Importance of Value Addition in Agriculture.....	17
2.5 Precolonial and colonial value addition initiatives to the production of oil palm	19
2.5.1 Post independence policies supporting value addition in the production of oil palm in Ghana.....	23
2.6 Summary.....	27

CHAPTER THREE	28
METHODOLOGY AND STUDY AREA	28
3.0 Introduction.....	28
3.1 Study area	28
3.2 Research Methodology	31
3.2.2 Research Strategy	31
3.2.3 Information sourcing	32
3.2.4 Secondary data.....	32
3.2.5 Primary data.....	33
3.2.6 Sampling Unit.....	33
3.2.7 Population.....	34
3.2.7.1 Sample Size determination	35
3.2.8 Quantitative process.....	36
3.2.8.1 Sampling Procedure.....	36
3.2.9 Qualitative process.....	38
3.2.10 Methods of Data Analysis	39
3.2.11 Measurement of Value Addition	40
3.2.12 Pearson Correlation Analysis	40
3.2.12.1 Test of Significance of Correlation Coefficient.....	41
3.2.12.2 Comparing Means of Several Groups.....	42
3.2.12.3 The ANOVA Procedure	42
3.2.13 Summary.....	43
CHAPTER FOUR	44
VALUE ADDITION ACTIVITIES IN THE OIL PALM INDUSTRY IN KWAEBIBIREM DISTRICT.....	44
4.0 Introduction.....	44
4.1 Upstream Production	44
4.1.1 Research.....	45
4.1.2 Nursery	48
4.1.3 Production.....	50
4.1.4 Harvesting and Marketing of Fresh Fruits Bunch	53
4.1.5 Spatial and Social Organisation of Processing Palm Fruit	56

4.1.6 Stages in the Processing Palm Fruits by Small Scale and Large Scale Sector	61
4.1.7 Value Addition to the Waste Generated in a Small Scale Mill	66
4.1.8 Palm Kernel Recovery and Kernel Processing	67
4.1.8.1 Technological Changes in the Kernel Processing Industry	71
4.1.9 Output Value Addition Marketing Strategies in the Oil Palm Industry	73
4.2.0 Midstream Production	76
4.3.0 Downstream Processing.....	76
4.3.1 Industrial End-users	77
4.3.1.1 Oleo Chemical Industry	77
4.3.1.2 Biomass Industry	78
4.3.1.3 Bio-diesel and Renewable Energy Production	79
4.3.2 Local End-users of the Palm and Kernel Oil	79
4.4 Conclusion	81
CHAPTER FIVE	82
CONTRIBUTION OF VALUE ADDITION TO SOCIO-ECONOMIC DEVELOPMENT	82
5.0 Introduction.....	82
5.1 Personal Characteristics of Respondents	82
5.2 Socio-economic Characteristics of Respondents.....	88
5.4 Employment.....	97
5.4.1 Test of Relationship between Income and Employment	98
5.5 Factors Accounting for Increased Income and Employment by Adding Value to the Palm Fruits and Kernels	100
5.5.1 Regression of Income on Years of Oil Processing in the Palm Oil Industry	106
5.5.2 Regression of Income on Years of Oil Processing in the Palm Kernel Industry	107
5.6 Multiplier Effects of Value Addition to Palm Fruits and Kernels in the Oil Palm Industry.....	108
5.6.1 Implication of Value Addition for Socio-economic Development.....	109

CHAPTER SIX.....	115
IMPLICATIONS OF VALUE ADDITION IN THE OIL PALM INDUSTRY FOR AGRICULTURAL POLICY	115
6.0 Introduction.....	115
6.1 Summary of Key Findings.....	115
6.1.1 The character of the activities that generate value in the oil palm industry	115
6.1.2 Contribution of value addition to employment and income	116
6.2 Conclusion	117
6.3 Policy Implication for Agricultural Production in Ghana	117
6.3.1 The Critical Role of Research in Agriculture	118
6.3.3 Nationwide distribution of improved planting materials.....	118
6.3.4 Enhancing Agriculture through Investment in Infrastructure.....	119
6.3.5 The Use of Efficient Technology	119
6.3.6 Developing the Capacity for Healthy Agro-Food Processing.....	119
6.3.7 Environmental and Natural Resource concerns.....	120
6.3.8 The Use of Standard Scale.....	120
6.3.9 Active Role of Public Institutions.....	120
6.3.10 Innovative Marketing and Distribution of Agricultural Products.....	121
6.3.11 Investment in Agro-industries	121
REFERENCES	122
APPENDICES	130
APPENDIX 1: QUESTIONNAIRE FOR SMALL SCALE PROCESSORS.....	130
APPENDIX 2: INTERVIEW GUIDES FOR KEY INFORMANTS.....	133
APPENDIX 3: INTERVIEW GUIDE FOR CHAIN ACTORS IN THE OIL PALM INDUSTRY (OPRI, GOPDC, FARMERS, TRADERS, AND PROCESSORS).....	134
APPENDIX 4: IFAD formula for sample size determination	135
APPENDIX 5: Measurement of value addition.....	135
APPENDIX 6: Population correlation between two coefficients.....	136
APPENDIX 7: Equation for calculating pearson correlation of coefficient.....	136
APPENDIX 8: Equation for calculating hypothesis used for Testing correlation	136
APPENDIX 9: Formula for computing the appropriate t value to test significance of a correlation coefficient	137

APPENDIX 10: Equation for the anova procedure	137
APPENDIX 11: Anova Table.....	138
Appendix 12: Descriptive Statistics of Incomes According To Factor Of Production.....	139
Appendix 13: Anova Test For Relationship Between Income And Other Variables	140
Appendix 14: Test For Anova Test For Relationship Between Income On Years Of Oil Processing In The Palm Kernel Industry	141
Appendix 15: Anova test for relationship between income and level of education.....	141
Appendix 16: Descriptive Statistics Of Incomes According To Level Of Education	142
Appendix 17: Anova Test of Relationship Between Income And Level Of Education	142

LIST OF TABLES

Table 3.1 Distribution of mills in Kwaebibirim District	35
Table 3.2 Distribution of mills in selected communities	37
Table 5.2 Age of processors in percentages	83
Table 5. 1 Age of processors in percentages	84
Table 5. 2 Marital status of palm fruit and kernel processors	85
Table 5. 4 The level of education of processors	87
Table 5. 5 Average Income generated from processing 1 tonne of palm fruit	92
Table 5. 6 Average income generated from processing 1 tonne of palm kernel	93
Table 5. 7 Seasonal income generated from selling palm oil	94
Table 5. 8 Average cost of operation and average sales output of various value addition activities for processing 1 tonne of palm fruit	95
Table 5. 9 Quantity of income generated from the sales of the palm nuts	96
Table 5. 10 Average cost of operation and average sales output of various value addition activities for processing 1 tonne of palm kernel	96
Table 5. 11 Test for correlation value added (income) and employment among palm fruit Processors	98
Table 5. 12 Test for correlation value added (income) and employment among palm kernel processors	99
Table 5. 14 Regression of the level of income and years of processing palm kernel.....	107
Table 5. 16 Distribution of income to meet socio-economic needs	109
Table 5. 17 Connections of value addition activities of processors to other industries....	110

LIST OF FIGURES

Figure 1.1 Value Chain Structure	8
Figure 1.2 A Simplified Representation of the linkages in the Value Chain	10
Figure 2.1 Old Oil Palm Belt in Ghana	22
Figure 2.2 New Oil Palm Belt in Ghana.....	24
Figure 3.1 Map of showing distribution of oil palm production activities in the study area, Kwaebibirem District	29
Figure 4. 1 A Diagrammatic Representation of the Upstream, Midstream and Downstream Activities in the oil palm industry	44
Source: Adapted from the Malaysian Oil Palm Council (2009).....	44
Figure 4. 2 Artificial Production of ‘Tenera’ Seed Nuts at OPRI	47
Figure 4. 5 The Flow of Palm Kernels from the Small Scale Palm Oil Mill to other users in the Kwabibirem District	71
Figure 4. 6 Processing of Palm Nuts into oil in a Small Scale Mill	72
Figure 4. 8 Value Web in the Oil Palm Industry	80
Figure 5. 1 Duration for participating in palm fruit and kernel processing activities	88
Figure 5. 2 Distribution of vertical productive activities engaged by processors	89
Figure 5. 3 Sizes of oil palm farms owned by farmer-processors in hectares	90
Figure 5. 4 Percentage distribution of palm fruits from the farm by farmer- processors	90
Figure 5. 7 Distribution of palm fruits and types of palm oil.....	104
Figure 5. 8 Distribution of varieties of palm oil in the study site.....	105
Box 1 A snapshot of the contribution of value addition to socio-economic development.....	111
Box 2 A snapshot of the contribution of value addition to socio-economic development.....	113

LIST OF ABBREVIATIONS

BCR-	Benefit Cost Ratio
BOPP-	Benso Oil Palm Plantation
CPO-	Crude Palm Oil
CSIR-	Council for Scientific and Industrial Research
CKO-	Crude Kernel Oil
DA-	District Assembly
EFB-	Empty Fruit Bunch
ECG-	Electricity Company Ghana
FFA-	Free Fatty Acid
FFB-	Fresh Fruit Bunch
FOHCREC-	Forest and Horticulture Crop Research Center
GOPDC-	Ghana Oil Palm Development Company
GLSS-	Ghana Living Standards Survey
GSS-	Ghana Statistical Service
GDP-	Gross Domestic Product
GRATIS-	Ghana Regional Appropriate Technology Industrial Services
IFAD-	International Fund for Agricultural Development
MAFAP-	Monitoring African Food Agriculture Program
MASDAR-	Masterplan Study on the Oil Palm Industry in Ghana
MOFA-	Ministry of Food and Agriculture
MOPB-	Malaysian Oil Palm Board
MOFA-	Ministry of Food and Agriculture
NASS-	National Academy of Agricultural Sciences
NBSSI-	National Board for Small Scale Industries
OPRI-	Oil Palm Research Institute
PFAD -	Palm Fatty Acid Distillate

PSI-	President Special Initiative
PKS-	Palm Kernel Shells
POME-	Palm Oil Mill Effluent
REP-	Rural Enterprise Project
RBDO-	Refined Bleached Deodorized Oil
RPKO-	Refined Palm Kernel Oil
SPSS-	Statistical Package for Social scientist
TON-	Tonne
TOPP-	Twifo Praso Oil Palm Plantation
USDA-	United State Department of Agriculture VC- Value Chain
WAIFOR-	West Africa Institute for Oil Palm Research

CHAPTER ONE

GENERAL BACKGROUND

1.1 Introduction

How to overcome poverty is a major socio-economic challenge facing developing countries. Although extreme poverty is a global phenomenon (World Bank, 2012), it is largely experienced in developing countries (Kanagawa & Nakata, 2008). This situation is attributed to several factors; they include: low levels of production, limited infrastructure, lack of applied technology, social and economic structures that do not facilitate development (Payne, 2005). According to a World Bank (2008) report, the number of people deprived of basic material requirement such as food, water, sanitation, clothing, shelter, health care and education is estimated at 1.29 billion. These conditions are mostly experienced by people who are in rural areas and are dependent on agriculture as their main economic activity (Kalu *et al.*, 2006).

Out of the number of poor population in rural areas, Sub-Sahara Africa is one of the poorest regions in the world (Sahn & Younger, 2009). The incidence of poverty in terms of percentage of regional populations is 47% and this is recorded as the highest rate of absolute poverty in the world (World Bank, 2010). The Ghana Living Standard Survey (GLSS, 2014) by Ghana Statistical Service (GSS) stated that the incidence of poverty is reducing. However, GSS's (2013) report on 2010 population and housing census is explicit on the fact that, poverty situation differs in various sectors of the economy and locations in Ghana.

Agriculture is the main economic activity dominating in the rural areas. The sector also engages about 73.5% agricultural households (Nyanteng & Dzah, 2013; GLSS, 2014). Yet, deprivation experienced in agricultural sector is reported to have contributed to 72.3% of overall national poverty (GLSS, 2014). Poverty among agricultural producers

is ascribed to the fact that efforts to increase agricultural productions have largely resulted in increased physical output than monetary value for producers (Mhango, 2010). This condition is attributed to the fact that, agricultural resources are sold raw or semi processed (Awua, 2000). Overcoming this situation requires introduction of new agricultural strategies (World Bank, 2001 cited in Kanagame & Nakata, 2008). According to Ngore *et al.* (2011), the addition of value in the production, harvesting, primary and secondary processing, packaging and export of agricultural produce form a value chain which has strong linkages either directly or indirectly to livelihoods. Therefore, there is a need to transform productions in agricultural sector into industrialized activities (Awua, 2000). This transformation changes the notion of looking upon agricultural production merely as an extractive activity.

1.2 Problem Statement

In Ghana, agriculture contributed about 30.2% to National Gross Domestic Product (GDP) in 2010 (MOFA, 2011a). Due to its role in the development of the national economy, agriculture has remained a major priority in state policies, poverty intervention programs and academic research. Strategies on agricultural development have been successful to the extent of supporting the growth of smallholder farming, ensuring food security and provision of raw materials for local industries among other issues (GSGDA, 2010). But, it has been acknowledged that there is a need to incorporate more innovative approaches to stimulate development (World Bank, 2006). These innovative approaches have the ability to expand opportunities and increase income for agricultural producers (Amoa-Awuah, 2009).

Much has been written about agriculture including oil palm farming in Ghana (see, for example, Bergert, 2000; Poku, 2002; Gyasi, 2008; Fold & Whitefield, 2012). Also, with

regards to innovative initiatives in agriculture, value chain module development and integration of smallholder farming into agricultural value chains are some of the areas that have recently received attention in research and literature. For instance, Leigh's (2002) study explored why some Ghanaian agricultural firms have succeeded at value addition exports and others have not. Scholz (2010) examined the social and economic incorporation of actors in the global shea value chain in Ghana. Adjei-Nsiah *et al.* (2012b) explored opportunities for enhancing innovation in agriculture in Ghana. They recommended that suitable institutional conditions were necessary for small scale producers to be integrated into the agricultural value chain. Ndidi *et al.* (2013) also studied the role of the private sector and the engagement of smallholder farmers in the food value chain in Ghana. Mele and Buschmann (2013) also conducted a comparative study on mango value chain model in Ghana, Benin, and Burkina Faso. Ofosu-Budu and Sarpong (2013) focused their study on value chain and smallholder farming in the oil palm industry in Ghana.

A review of pertinent literatures as elaborated above shows that very little research work has been carried out on value addition in agriculture. The study focuses on value addition because it has not been adequately emphasised in previous studies in agriculture, particularly in relation to the oil palm industry in Ghana. In addressing the issue of poverty reduction in agricultural sector, this study poses two central questions: how can value addition in agricultural production chain generate income and employment? What are the value addition strategies that ought to be adopted by producers in order to strengthen agricultural value chains? The study accordingly addresses the issue of value addition in agriculture in relation to its contribution to socio-economic development with reference to the oil palm industry.

1.3 Objectives

It is against this preceding background that this study focuses upon value addition, particularly, its implications for socio-economic development with reference to the oil palm industry in Ghana. The oil palm is selected among other crops because: firstly, it is one of the crops which have been demonstrated to have the capacity to reduce rural poverty (Gyasi, 1991); secondly, it has reduced agriculture labour productivity gap in Malaysia (Basiron *et al.*, 2004); thirdly, it is an excellent example of agricultural production that embodies concerns for food security (Basiron, 2007). In specifics, the study seeks firstly, to determine the character of the activities that generate value along the chain of production and service delivery in the oil palm industry.

Secondly, it aims at finding out how the process of value addition contributes to development, especially in terms of employment, income, and poverty reduction. In this respect, an attempt is made to quantify the value added.

Finally, the study analyses the wider policy implications of encouraging activities that generate value in agricultural sector as a strategy of sustainable rural development.

Therefore, the study addresses the following questions:

1. What are the activities that add value along the chain of production in the oil palm industry in Ghana?
2. What are the contributions of these activities to socio-economic development especially, income generation, employment and poverty reduction?
3. What are the policy implications for encouraging activities that generates value in agricultural sector?

1.4 Research Hypotheses

The core proposition of the study is that value addition in agricultural production plays significant role in development. This premise is stated because it is assumed that addition of value increases the amount of goods produce in a production system. Since production quantity is enhanced through value addition, it can be alleged, a prior, that, value addition increases income and generates employment.

Secondly, it can be alleged that value addition as an economic activity is dependent on a lot of factors of production. A logical implication of this argument is that value addition in the oil palm industry is sustained by the adoption of innovative strategies including the use of improve planting materials, methods of production, experimentation, and the provision of necessary support services.

Thirdly, since value addition in the oil palm industry entails growing income and employment, it would seem reasonable to expect a growth of other industries in oil palm producing areas.

1.5 Theoretical Framework

1.5.1 Value chain framework

The analysis of value addition in the oil palm industry draws heavily from the value chain theory because the underlying drive of value chain theory is to alleviate poverty among small scale industries and smallholder farmers participating directly or indirectly in global trade (Kaplinsky & Morris, 2000). Also, the theory posits that, each point or linkage in the value chain presents an opportunity for people to engage in innovative activities for income and employment (Kaplinsky, 2013; Kaplinsky & Morris, 2000; Sturgeon, 2008; Webber & Labaste, 2010). The total benefit that can be derived by a value chain actor is directly proportional to the number of activities engaged in by actors.

Value addition activities within the chain differs at each stage hence, producers have the opportunity to choose the type of activity that generates more reward (Kaplinsky, 2013). In this connection, Webber and Labaste (2010) indicated that value chain is the same as filiérés, marketing chains, supply chains, productive chains, and distribution chains because it involves the supply of logistics, value addition, transactions, and market linkages. However, in this study, value chain is used as a tool to aid in the demonstration of new value adding opportunities, actors, and to categorize the value chain as starting from the customer's perspective to the development of the product. Therefore, the terms market chain, supply chains, and distribution chain are not synonymous. Value chain is used in this study as it has been referred to in its original sources.

A value chain is a full range of interconnected value adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs, assembly, physical transformation, acquisition of required services such as transportation or cooling, and ultimate response to consumer demand (Janssen *et al.*, 2010 cited in Rakho, 2012). In order to strengthen the connections in the chain, Chege (2012) indicated that post consumption activities like recycling, recovery, and re-use of waste and environmental value is incorporated into value chain theory.

Value chain characteristics have been identified by Webber and Labaste (2010). First, it focuses on net value added instead of overall revenue and gross physical output. Secondly, it concerns with cost build-up and value accretion, as well as the distribution of burdens or benefits. Thirdly, it recognizes that linkages between productive activities and actors vary according to the specific product type and target market. Furthermore, it recognizes that economic activities are dynamic which necessitates adjustments in strategy and tactics constantly as circumstances change. It also recognizes that there are

different kinds of value chains depending on the activity that has most leverage, information, and power. It looks at physical and information flows. Lastly, it seeks to understand the constraints and opportunities within each segment, as well as the context in which the chain operates. Consequently, each of the characteristic described consist of interactions between some structures and elements. Kalu *et al.* (2006) indicated that value chain consist of dynamic elements and structures which have strong interactions existing between them. A broad structure of a value chain is characterized by: end market; business and enabling environment; vertical linkages; horizontal linkages; and supporting services.

End market is one of the structures of a value chain. It basically refers to the consumer who has the ability to determine production, processing, marketing and distribution of products (Boehlje *et al.*, 1999; Coltrain *et al.*, 2000; Sturgeon, 2008). Innovation in global value chain lies in the buyer's ability to control a product's design and marketing than in manufacturing know-how (Sturgeon, 2008). Global buyers have power to create, place orders, shape and coordinate the value chain (Sturgeon, 2008). The power wielded by buyers is used to specify what, how, when, where and by whom the goods are sold in the chain. End markets help in the formulation of businesses and enabling environment.

Business and enabling environment as a structure of a value chain, refers to the bye laws, norms, regulations, policies and bilateral and multilateral trade agreements. These Steering mechanisms can affect product supply in the form of import tariff, quotas, minimum prices, subsidies, investment subsidies, factors of production/input subsidies or any other subsidies. Enabling environments are either regulated locally or by global retailers. (Sturgeon, 2008). It also involves the availability of infrastructure such as road, electricity, water, technologies and others which aid in the flow of commodity, finances,

services and information along the value chain (Sturgeon, 2008). Business and enabling environment connect either vertically or horizontally with other structural elements.

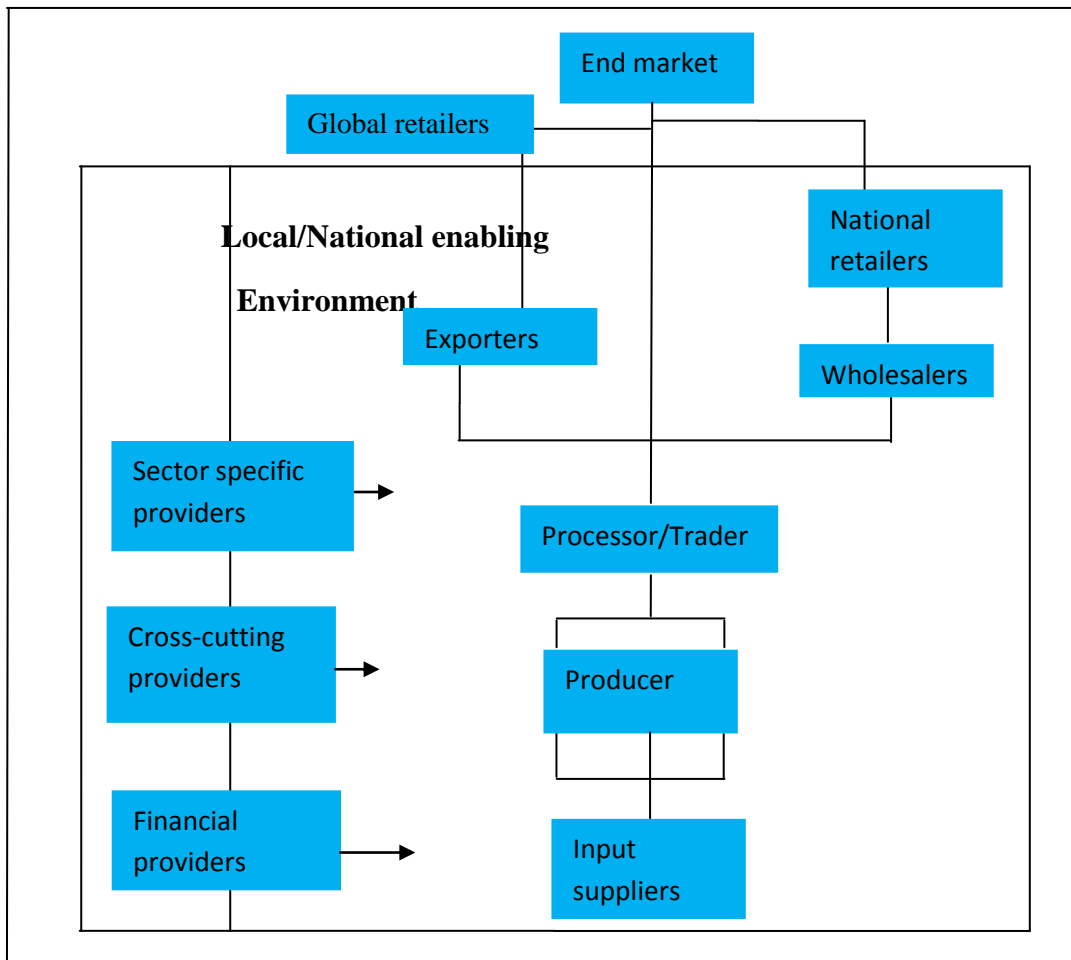


Figure 1.1 Value Chain Structure

Source: Adapted from Kalu *et al.* (2006)

The vertical linkages connecting various nodes on figure 1.1 denotes the relationship among actors and activities in a value chain. Coltrain *et al.* (2000) referred to it as a vertical integration because, the control of all segment of production and market is under a single ownership in the value chain. The issues aligned and controlled in a vertical linkage include price, quality, quantity, and transactional terms of exchange (Sporleder, 1992 cited in Coltrain *et al.*, 2000). A strong vertical linkage in a value chain involves producers taking charge of processing, marketing and distribution of products. Examples

of vertical linkages include contracting, strategic alliances, and single ownership of multiple market stages in different levels of a commodity (Boehlje *et al.*, 1999).

Every chain has a vertical and horizontal linkages but vertical linkages operate mostly in association with external structures. Accordingly, horizontal relationships exist among actors at the same level of the value chain (see figure 1.2); example is value added cooperatives combining their goods for a particular market. Moreover, horizontal relationship involves consolidation among individuals or companies from the same level of the chain so that each actor enjoys economies of scale by coordinating their activities (Coltrain *et al.*, 2002). The linkages in the chain enables: identification of opportunities between organization and actors; values to be gained; and position producers to compete in global markets (Webber & Labaste, 2010).

Furthermore, support services are also important structures of a value chain. These are in the form of financial services, cross-cutting services such as business consults, legal advice and telecommunications, and sector specific services (Sturgeon, 2008). Support services may be provided by actors in the chain or by sole service providers. The services provided by actors in the value chain include cost of business transactions. The structures in an agricultural value chain discussed above operate with some elements.

The elements that interact and shape the structure of a value chain include upgrading or innovation, governance, information transfer, inter-firm cooperation and competition, and power exercised by businesses in their relationships with each other (Boehlje *et al.*, 1999; Amanor-Boadu, 2003; Webber & Labaste, 2010). The characteristics, structures and element of the value chain theory make it a suitable instrument to demonstrate the issue of value addition in the oil palm industry.

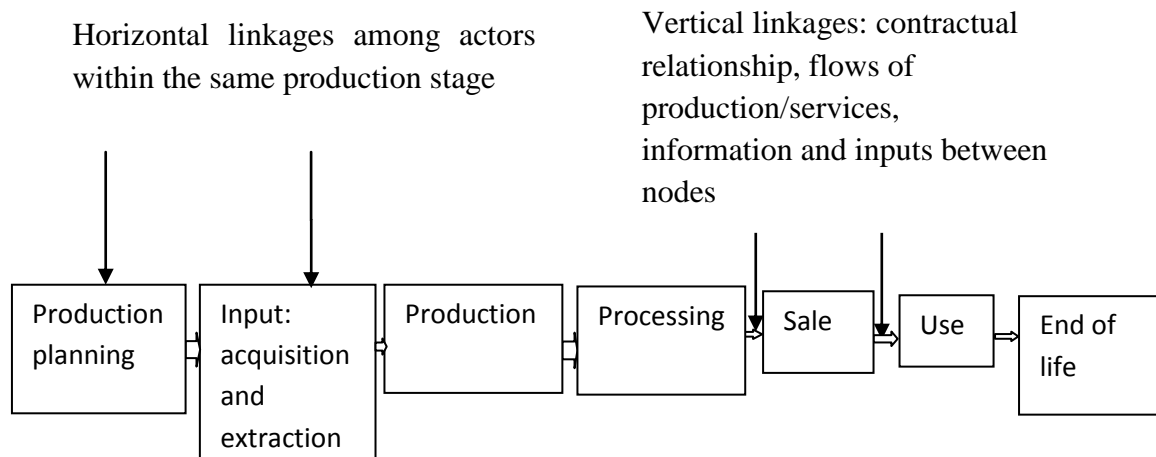


Figure 1.2 A Simplified Representation of the linkages in the Value Chain

Source: Author's construct that draws from Kaplinsky and Morris (2000), Scholz (2010)

1.6 Structure of the study

The study is organised into six chapters as describe below.

Chapter 1, titled general background, introduced the study, its objectives, hypotheses and theoretical background of the study. Finally, the structure of the study is outlined.

Chapter 2, which is captioned literature review, evaluates pertinent literature on value addition in agriculture and the oil palm industry in Ghana.

Chapter 3 describes the study area and the methodological approach adopted in carrying the study.

For chapter 4, it is titled value adding activities in the oil palm value chain in Kwaebibirem District. It narrates the character of activities that generates value and service delivery in the oil palm industry.

Chapter 5 is termed as contribution of value addition to socio-economic development.

This chapter quantifies the amount of income generated through value addition.

Subsequently, it analyses the number of people employed to process palm fruits and kernel and its implication for socioeconomic development.

Chapter 6 is the concluding chapter. It bears the title, implications of value addition in the oil palm industry for agricultural policy. This study first drew a conclusion on the findings of the preceding chapters of the study, followed by recommendations for the development of value addition in agricultural productions in Ghana.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on value addition, strategies of value addition and socio-economic importance of value addition in agriculture. The chapter also analyses literature on the oil palm industry with a focus towards understanding how state policies contribute to value addition.

2.1 The Concept of Value Addition in Agriculture

Value addition in agriculture is variously defined because it encompasses many innovative activities which stems from producers creativity (Knop & Tronstad 2000; Fairbairn & Gustafson, 2004; Ernst & Wood, 2011). In agriculture, value addition describes changes, modifications, improvements, and enhancements of production, processing, and marketing activities. Ernst and Wood (2011) supported this claim by pointing out that, value addition is not related to a specific activity because it is an outcome of creative imagination of producers. Lewis (2002) citing Maetzold (2000) termed value addition in agriculture as a process that: (a) changes how a product is marketed; (b) changes the form of the commodity; (c) changes the way commodities are packaged; (d) changes how a commodity is cultivated for a special market and; (e) adds to a new enterprise. Whereas Maetzold's (2000) definition stressed on value addition in marketing agricultural products, the United States Department of Agriculture (USDA) (2002) provided an encompassing definition of value addition in agriculture as: (1) a change in the physical state or form of the product; (2) the production of a product in a manner that enhances its value, as demonstrated through a business plan; (3) the physical segregation of an agricultural product in a manner that results in enhancement of the

value of that product. Equally important to these definitions, is a modification of the USDA's (2002) definition. It states that, value addition is "a business initiative in which particular members of a supply chain are rewarded for undertaking activities that have hitherto been performed by downstream firms in a supply chain, or for performing activities that are deemed valuable but have thus far been overlooked in the supply chain" (Amanor-Boadu, 2003, pg. 3-4). In support of this idea, Fairbairn and Gustafson (2004) stressed further that, value addition in agriculture involve new ways of using agricultural products. Based on the ideas expressed in the above definitions, this study defines value addition as any innovative activity carried out by a farmer, processor, or trader that transforms a product a step closer to the form desired by a customer who is ready to pay extra income for undertaking such an activity.

2.2 Characteristics of Value Addition in Agriculture

According to the Indian National Academy of Agricultural Sciences (NASS, 2002), value addition in agriculture aims at producing from the consumer's perspective. Thus, Curtis and Cowee [n.d] asserted that value addition in agriculture is embedded in a consumer's perceived values. Coltrain *et al.* (2000) summarized the attributes of the perceived values cherished by consumers to include: quality, functionality, form, place, accessibility and time. Anjum [n.d] also indicated that price, variety, convenience, quality, safety, health and environmental consciousness are some of the perceived values appreciated by consumers. Furthermore, Coltrain *et al.*, (2000); NASS (2002); Amanor-Boadu (2003); Anjum [n.d]; and Evans (2012) have identified some characteristics of value addition in agriculture and these are as follows:

- It is consumer driven.
- Consumers are willing to pay premium prices on the value added to a product and this, increases or stabilizes profit.
- It can be anything that enhances a product and expands the market of a product.

- It includes enhancement of food, non-food products and re-use of wastes.
- Value addition in agriculture makes the farmer a processor and distributor, thus, shortening the distance in the agricultural chain.
- It takes the interest of producers, small scale businesses, local citizens and local resources into consideration.

Apart from the fact that value addition in agriculture is consumer driven, it promotes a 'win win' strategy in agriculture, because producers benefit from innovative activities (Webber & Labaste, 2010). The rewards of value addition to the producer are summarized as; higher prices, increased market share or increased access to market (Amanor-Boadu, 2003). The summary of the characteristics of value added agriculture shows that this form of agriculture is different from the normal agricultural production. Therefore, a producer engaged in value added agriculture should ask the following questions: is it consumer driven? Has the market base of a product increased? Has profit increase? Should answers to these questions be negative, then, it can be assume that the activity is not a value added initiative (Evans, 2012).

2.3 Strategies of Value Addition in Agriculture

Value addition strategies are mostly referred to as, examples, forms and dimensions of value addition in the literature (see, for instance, Danielson & Park, 2001; Tubene, 2002; Craig & Brown, 2002; Anjum [n.d]; Evans, 2012; Curtis & Cowee [n.d]). The strategies of value addition are, cleaning, cutting, cooling, processing, distribution, churning, culturing, labelling, smoking, packaging, drying, extracting, and grinding (Anjum [n.d]; Sauzet, 2009). According to Chege (2012) the use of technologies, labour-saving steps and innovations at production stage are forms of input value addition strategies. Some input value addition activities that are carried out at the production stage of agriculture have been identified in the literature.

Chege' (2012), Hardesty (1992) and Fairbairn and Gustafson (2004) showed that cooperative is, a value addition strategy. Value added cooperative according to Hardesty (1992) is different from 'ordinary' cooperative because it involves activities that range from, production, marketing and trading of agricultural. Whereas the former pertains mainly to enhancing financial needs of its members (Fairbairn & Gustafson, 2004). Value added cooperatives are characterised by adopting strategies such as: formation of community market for producers to locate markets with high rewards, share economic risk and opt for better bargaining power (Kibbe, 1996).

An equally important input value added strategy is organic agriculture. It is practiced by farmers to meet the needs of consumers who are environmental or health conscious. Market for organic agricultural products is increasing with associated prices for producers (Fairbrain & Gustafson, 2004; Evans, 2012; Curtis & Cowee, [n.d]). Strategies approved under organic agriculture include cultivation of crops, rearing of animals and processing of agricultural produce organically. Organic market for agriculture is increasing in areas where consumers rate health and wellness issues above other factors (Wivstad, 2013).

This view is supported by Sauzet (2009), who also indicated that health challenges have also caused consumers to be aware of the need to consume quality and standard foods. Craig and Brown (2002) again stressed that, increased outbreak of food borne diseases such as salmonella, campylobacter jejuni, shigella, Escherichia coli, listeria monocytogenes and vibrio have caused consumers to be conscious about quality. Therefore, production of quality foods by farmer-processors has been regarded as a value added strategy. As such, consumers are concern about developing relationship with producers in order to check for quality (Curtis & Cowee, [n.d]).

Studies by Dietz and Cowell (2005) indicate the use of computers, Global Positioning System (GPS), microchips, internet and biotechnology as strategies of value addition in agriculture. The availability of this equipment enables farmers to receive information about consumer's needs, prices, and check for quality in their products (Chege, 2012). Hence, technologies, organic agriculture, and cooperatives are examples of input value addition strategies.

Output value addition strategies on the other hand involve marketing and distribution plans adopted by producers to satisfy customers downstream (Chege, 2012). One output value added strategy identified in the literature is niche marketing. It is a process whereby a farmer may produce a specific food product to meet the needs of some sections of the population (Flemming, 2005). Product diversification and differentiation is an example of niche marketing. In their review, Boehlje *et al.*, (1999), Danielson and Park (2001), and Flemming (2005) stressed further that farmers are able to attain profit because consumers are willing to pay premium for this value adding activity.

Tubene (2002), Ackerman (2010), and Evans (2012) cited that direct marketing is also a form of value addition strategy. This is because farmers sell directly to consumers without engaging middlemen in the production chain. Direct marketing is achieved by farmers through roadside markets, farmer's stands, community markets, bread-and-breakfast farm accommodation, and farm festivals.

Closely linked to direct marketing, is vertical integration of agricultural production activities by a lone producer. Farmers are increasingly participating in processing and distribution of farm products (Lewis, 2002). This strategy, according to Ackerman (2010), creates a direct linkage between consumers and producers. The advantage of

farmers merging production, processing and marketing into their activities enables them to accrue all the profit in the production chain (Fairbairn & Gustafson, 2004).

Another output value addition strategy identified in the literature is regional branding. Ackerman (2010) and Docherty (2012) specified that, branded products are connected to consumers and to the geographical origin of agricultural products. It is assumed that agricultural productions in some geographical areas are categorized by standard, quality and low prices (Ackerman, 2010). As a result, consumers brand food with peculiar characteristic and origin as value added (Fairbairn & Gustafson, 2004).

Some literatures have also acknowledged re-use of waste generated on the farm as value addition strategy (Krell 1996; NAAS, 2002; Knop & Tronstad, 2000). Waste generated on the farm or mill is used mostly for mulching, fertilizing, and some are reprocessed into new products. Value addition strategies, whether input or output have various repercussions on producer's income in agriculture. The strategies discussed in this subsection is relevant to the discussion of the character of activities that generate value along the chain of production and service delivery in the oil palm industry in chapter four.

2.4 Socio-Economic Importance of Value Addition in Agriculture

The strategies of value addition in agriculture have ability to translate into socio-economic gains for producers (Ngore, 2010). Rural farmers are able to compete on price and non-price basis as a result of adding value to their products (Krell, 1996; Sauzet, 2009). Knop and Tronstad (2000) also indicated that value addition in agriculture diversifies the economy of rural communities. Rural economy is noted to be characterized with agriculture and its related activities (Ngore *et al.*, 2011). As such, through the initiative of value addition, farmers or processors have access to diversities

of strategies to generate income (Ngore *et al.*, 2011). This results in increased demand for additional hands from household members or the community. Therefore, unemployment and underemployment situations are reduced. It leads to the creation of multiplier effects in the local economy because new business ventures evolve in the local economy as demand for value added products increase (Danielson & Park, 2001; Fairbairn & Gustafson, 2004).

Krell (1996) has also stated that, value addition stabilizes income by altering production processes through recycling and reuse of waste to generate new products. This is important because during lean seasons, farmers have little income generating activity to undertake (Scholz, 2010). Hence, producers who are able to add value in their production processes have competitive advantages over other by engaging in value added activities on the farm (Chege, 2012).

Krell (1996), Lewis (2002), Dietz and Cowell (2005) have also mentioned that, when income, employment opportunities and other benefits are in abundance, there will be low tendency for youths to migrate to urban areas. Furthermore, Born (2001) asserts that value addition in agriculture provides opportunity to explore local knowledge, innovation, and skills. This is evident in advertisement, packaging, production and marketing of agricultural products (Danielson & Park, 2001). Value addition makes agriculture more dynamic, rewarding and promotes culture of research and learning (Kalu *et al.*, 2006). Value addition can therefore serve as a tool to contribute to sustainable rural development.

State polices have been significant to the adoption of value adding activities in the oil palm industry and for the ultimate development of rural areas in Ghana. Therefore, the next section throws light on how local or national policy settings in the value chain

theory (section 1.5.1, figure 1.1) have influenced value addition in the oil palm industry. The discussion on policy contribution to value addition in the oil palm industry is carried out from precolonial, colonial era, and post independent era to the present.

2.5 Precolonial and colonial value addition initiatives to the production of oil palm

Before the arrival of the Europeans, people of West Africa and Gold Coast had already established an economic system which revolved around the oil palm (Aghalino, 2000). This is ascertained by earliest archaeological evidence on palm oil consumption found in an Egyptian tomb in Abydos. Since no palm oil was produced in Egypt, it is assumed that palm oil was transported from West Africa to North Africa (MOPB, 2009). Towards the end of the 15th century, Sub-Sahara Africa was introduced into the Trans-Atlantic trade (Owusu, 2007). The exchange of palm oil in the international trade transformed the oil palm industry in the Gold Coast. Consequently, palm oil trade became important in the second half of the 19th century after the abolition of the slave trade; the inauguration of the industrial revolution; and the development of the railway (Dickson, 1969; Lynn, 1997; Bergert, 2000, MAFAP, 2013). It means that apart from the value derived from the oil palm by indigenous people, high values were also discovered from the palm oil in Europe.

The oil palm thus, emerged as ‘the new gold’ when it was discovered as raw material to feed industries in Europe (Owusu, 2007). Different uses of the kernel were also discovered in the new product margarine, and the residue from the extracted oil was discovered to make good livestock feed (Coley & Tinker, 2003). The British developed improved varieties of the oil palm from the West Africa Institute for Oil Palm Research (WAIFOR) established in Nigeria, for farmers in the sub-region. This marked the

introduction of what is referred to in local parlance as 'agricabe' which is rich in palm oil (Dickson, 1969; Owusu, 2007).

These developments encouraged indigenes in the southern sector of the Gold Coast to cultivate cash crops for the international trade. The colonial administration also played a role in this instance, by promulgating agriculture programs. This is because agriculture was seen as a way to increase export of cash crops to Europe (Dickson, 1969). As a result, trade in all forms of agricultural produce began to blossom especially, palm oil.

During this period, the oil palm was harvested from the wild groves. Gyasi (1992a) asserts that the oil palm grew in the wild in some areas located near the coast. Specifically, the oil palm belt in the wild extended for about 500km from the southeast to the southwest coast with an approximate width ranging from 8 to 60 km (see figure 2.1). As palm oil gained importance in the international trade, people began to cultivate the oil palm within the same belt which was colonized by wild palmeries (Gyasi, 1992a). This area according to Gyasi (1992a) was not the ecological niche for the cultivation of the oil palm. However, high tropical climates which prevailed at the time along the coast supported its growth. Political insecurity due to inter-tribal wars in the interior parts of the country; slave raids; poor transportation systems; and the weight of palm oil also encouraged oil palm cultivation and processing along the coast (Dickson, 1969; Gyasi, 1992a).

The glory of the trade in palm oil reached its peak in the year 1884, when Ghana exported about 20,000 tons of palm oil and 40,000 tons of kernels to Europe. Palm oil became the most important export commodity in the 19th century (Gyasi, 1991). The success of the export business is credited to several initiatives such as, oil palm plantations established by the Dutch, Germans, French and British. In addition,

processing mills were also established at Krobo traditional area, Winneba, Dzodze and Sekondi to aid in palm oil production (Dickson, 1969; Gyasi, 1996). Even so, export of palm oil and kernels could not be sustained as the trade began to decline in 1905 (Bergert, 2000). This occurrence was attributed to the fall in global selling price; the laborious and time consuming activities associated with processing palm and kernel oil; and high cost of transporting palm oil to the coast (Dickson, 1969).

During this period, oil palm plantations established by Europeans in Sumatra, Malaysia, and the Belgian Congo were also selling in the world market. Subsequently, supply of palm oil exceeded its demand in the international market leading to the fall in the price of palm oil. Faced with these difficulties, cocoa emerged as a new export crop and was subsequently adopted by farmers in the forest region (MASDAR, 2011). Oil palm trees were felled for the production of palm wine, a locally manufactured gin called 'akpeteshie' (Dickson, 1969). The colonial administration responded to the situation by introducing oil palm plantations and processing mills in the forest regions. However, oil palm plantations failed to make any significant impact on the economy because of low prices of the palm oil and kernel in the European market.

Hence, colonial administrators could not convince indigenes to produce oil palm plantations (Fold & Whitefield, 2012). Oil palm production continued to decline until post independent government policies were implemented to revive production in Ghana.

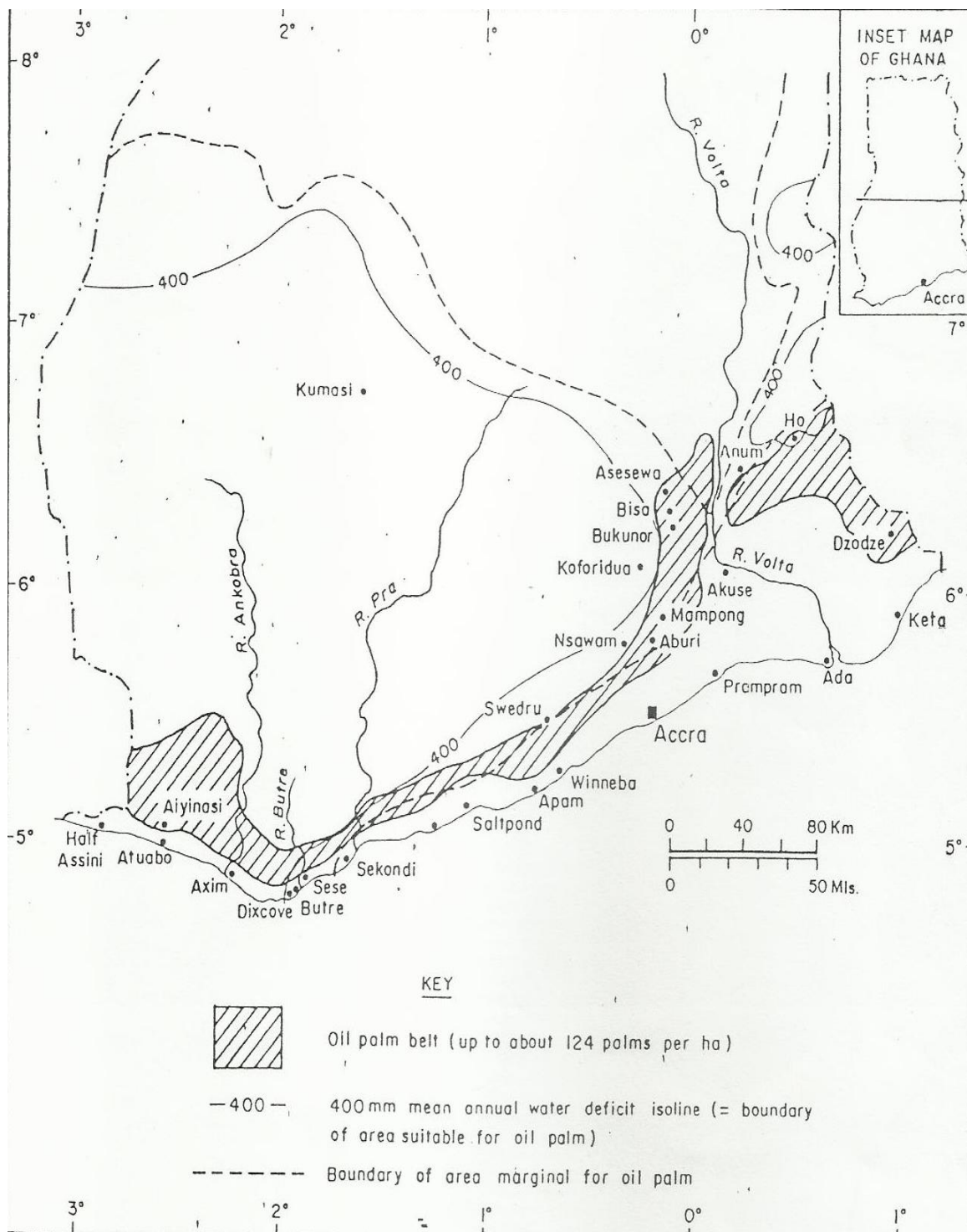


Figure 2.1 Old Oil Palm Belt in Ghana

Source: Gyasi, 1992a

2.5.1 Post independence policies supporting value addition in the production of oil palm in Ghana

After independent, state elites were motivated to support oil palm production because of the need to reduce pressure on foreign currency reserves caused by huge import bills (Fold & Whitfield, 2012). The year 1960 marked the beginning of efforts made by the state to promote palm oil production in Ghana (Danyo, 2013). This was made possible through government policies and programs. The Ghana Oil Palm Research Institute at Kusi, was established and vested with the mandate of producing high yielding oil palm varieties in Ghana. State farms and nucleus estates cultivated with oil palm, and processing mills were also established at various part of southern Ghana. These initiatives contributed to the growth and spread of oil palm in new areas, north of the old belt (Gyasi, 1988; Gyasi, 1992a). In addition, urbanisation and change in climatic conditions along the coast had also caused a decline in the cultivation of oil palm in the old belt. Subsequently, there was a shift on the production of oil palm to its ecological niche (Gyasi 1991). According to Gyasi (1992a), the largest oil palm growing areas in the new oil palm belt extended westward from the Lake Volta to Benso in the Western region as demonstrated on figure 2.2. Also, the area around Kade represents a core region of oil palm. It extends to about 100 km from Asamankese through Kusi, Kade, and Kwae to Akoase near Nkawkaw in the Eastern region (Gyasi, 1992a).

The vast expansion in oil palm plantation under a five year development plan (1959- 64) was meant to introduce economic and industrial development in the country (Ntsiful, 2010). Ghana Farmers Council distributed oil palm seedlings to its members under this program. In addition, 2, 565 hectares of oil palm were cultivated in various parts of the country with a palm oil processing mill established at Asesewa (MASDAR, 2011). In spite of the promising nature of the policy, state farm projects were not fruitful because

of mismanagement, lack of financial support and political interference through 1966 military coup (Ntsiful, 2010). Two different administrations that is, the National Liberation Council and the Progress Party (1966-1972) tried to revitalise the oil palm industry by privatizing some estates but they were unsuccessful because of the political situation prevailing in the country (Foli 2010 cited in Fold & Whitfield, 2012).

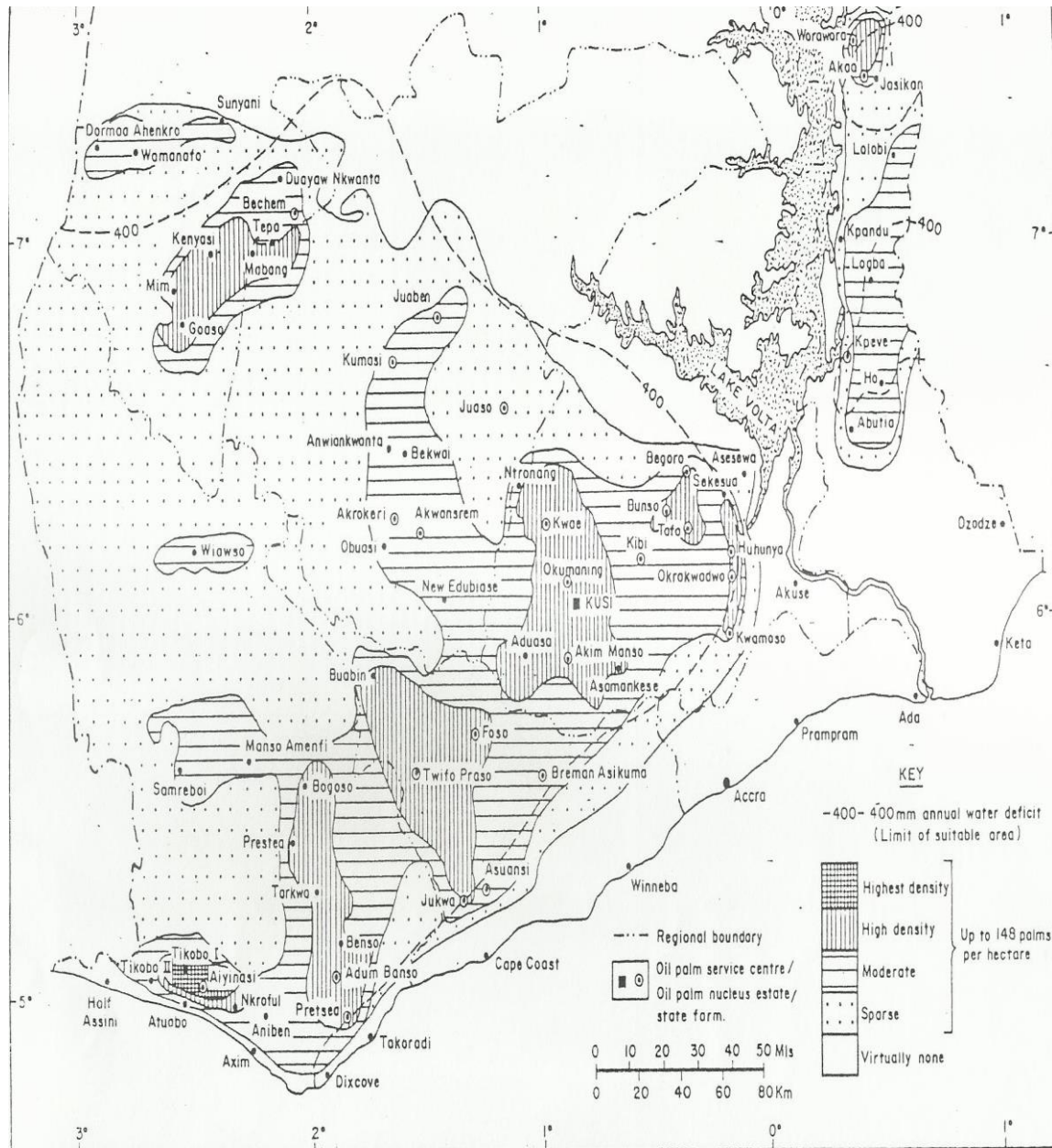


Figure 2.2 New Oil Palm Belt in Ghana

Source: Gyasi, 1991

The oil palm industry was fully revived under Acheampong's administration after a five year development plan was instituted in 1975/76. This was because domestic production of palm oil in 1972 was meeting only 43% of demand meant for industrial processing (Fold & Whitfield, 2012). The new policy called for private sector support through financial and technical assistance to smallholder and out-grower farmers. This was an integral part of plantation development and the state was a lead player. Subsequently, the state received external support from Commonwealth Development Corporation, European Community, World Bank, International Finance Corporation, African Development Bank, FMO (Dutch Financing Company) and Agence Française de Development. Through their support, Benso Oil Palm Plantation (BOPP), Twifo Praso Oil Palm Plantation (TOPP), and Ghana Oil Palm Development Corporation (GOPDC) were established. However, the existing National Oil Palm Limited (NOPL) was revamped with support from external donors and the State. This extended the total area cultivated under oil palm from 17,000 hectares in 1970 to 103,000 hectares in 1990 (Gyasi, 1991, Gyasi, 1992a).

Value addition was carried out in the oil palm industry in a different dimension during structural adjustment era (1980's to early 1990's). As part of the five year development plan, there was privatization of non-viable state properties including state farms and processing mills. The expropriation of land during the creation of plantation projects in the 1960's and 1970's caused land litigations, protests by peasant farmers and delays in getting the large estates operational during the privatization exercise (Gyasi, 1992b; Gyasi, 1996). Privatization of state owned oil palm plantations and estates continued in the late 1990s. In 1994, the government of Ghana sold 80 percent of its shares and management control in GOPDC to SIAT Ghana Consortium. In 2004, the state offloaded

58% of its shares in BOPP to Unilever. In 2008, 20% of the state's shares in BOPP were also sold. In 1997, government sold 40 percent of its shares in TOPP to Unilever. Therefore, BOPP and TOPP are now managed jointly by Unilever. The National Oil Palms Limited was sold in 2000 to Norpalm AS, a company from Norway. Small state owned plantations and mills were bought by Ghanaian entrepreneurs or by large estates with the aim of expanding oil palm production (MASDAR, 2011; BOPP, 2003; Fold & Whitfield, 2012). As a result of privatisation of state owned plantations, there were no oil palm farms owned by the state.

In 2003, a new oil palm policy called the Presidential Special Initiative (PSI) on the oil palm was launched to recuperate and expand cultivation and processing. PSI on the oil palm aimed at building the rural industry, creating rural employment and empowering smallholder farmers (Asante, 2012). Under the initiative, landowners contributed land within a certain radius to be used by groups of farmers. The total area of oil palm cultivated under the initiative, expanded by 10,000 hectares of small scale farms with high-yielding varieties. The scheme later failed because of past experience of state in expropriating communal land, political apathy, insufficient funds, and poor management (Fold & Whitfield 2012; Asante, 2012).

Afterward, a new oil palm master plan was launched in July 2012 under a different political administration. The plan is designed to guide the state to promote a competitive oil palm sector in the country. It proposed a 10,000 hectare oil palm nucleus estate and processing mill to be sited in the Pretsea-Huni District in the Western Region. It also included a village level small mill which is to be associated with a proposed nucleus estate (MASDAR, 2011; Bonney, 2012). With the master plan, it is expected that Ghana will experience an expansion in the total area cultivated under oil palm (MASDAR, 2011). The contribution of international donors, state motivations, and policies are forms

of support services and enabling environment created to enhance value addition in the oil palm industry.

2.6 Summary

The chapter reviewed theoretical and empirical literature on value addition in agriculture. The literature basically indicates that value addition in agriculture is consumer driven. This enables producers to be flexible and innovative to produce accordingly. The literature also established that, local, national, and international policy environment have implications on value addition in the oil palm industry.

CHAPTER THREE

METHODOLOGY AND STUDY AREA

3.0 Introduction

This chapter provides an overview of the study area. This is followed by a discourse on the methods used in collecting data for the study.

3.1 Study area

Kwaebibirem District, the focal study area, is a major producer of oil palm in Ghana. It is located in the south-western corner of the Eastern Region of Ghana. It is bounded by the Birim North District on the west, Atiwa District on the northeast, and on the east by the East Akim Municipality, on the south east by the Suhum Kraboa Coaltar District, to the south by the West Akim Municipality, and the Birim South District on the south-west. The district has a surface area of about 1, 230 square kilometer (Kwaebibirem District (Kb. DA), 2006). The district lies within the semi-deciduous forest agro-ecological zone of Ghana with a double maximal mean annual total rainfall of 1500mm. Temperature ranges between a minimum of 26.5⁰C and a maximum of 27⁰C. The soils are silty and silty clay loam forest ochrosols. These are fertile soil, slightly leached, moderately acidic and have neutral Ph (Kwaebibirem District ssembly, 2006).

Agriculture is the major economic activity in Kwaebibirem District (Ofosu-Budu & Sarpong, 2013). It is dominated by food crop production; however, cash crops are also cultivated in the district. The cash crops include cocoa, oil palm, black pepper, cola, para rubber and citrus. In terms of occupational structure, agriculture employs 76.8% of the labour force. Two thirds of the population numbering about 13, 095 are engaged in agriculture especially oil palm production (Osei-Amponsah, 2013). Agriculture is on

smallholder basis with average farm size of about 5 acres and few farmers engaged in plantation farming (Kwaebibirem District Assembly, 2006).

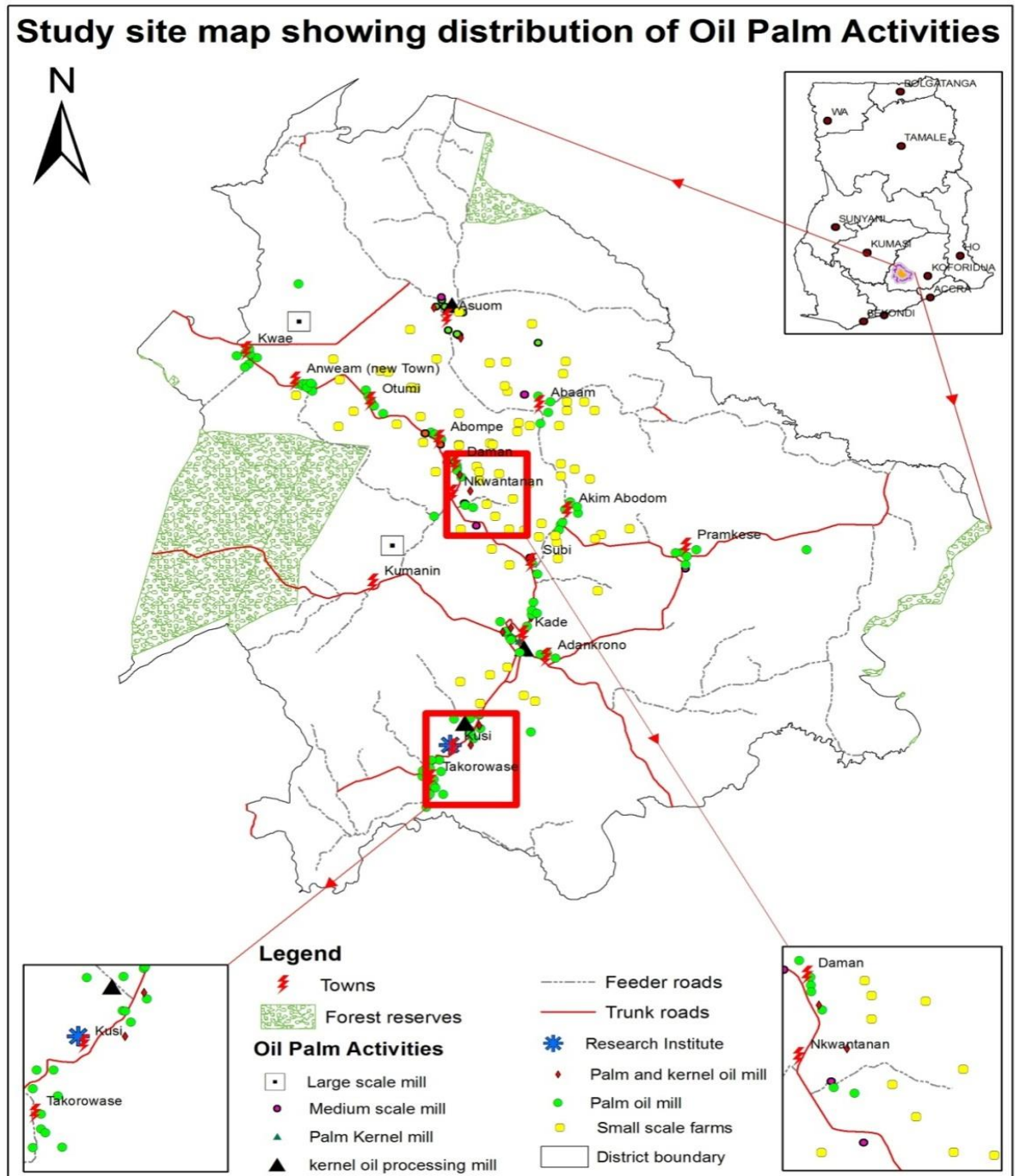


Figure 3.1 Map of showing distribution of oil palm production activities in the study area, Kwaebibirem District

Source: Author's field survey, March 2014

The district hosts the biggest oil palm plantation in the country which is, Ghana Oil Palm Development Company (GOPDC). The GOPDC has its headquarters at Kwaebibirem but it manages about 20,500 hectares of oil palm plantations at Okumanin and Kwaebibirem (MOFA, 2012b). Also, GOPDC has an out-grower scheme, with about 14, 000 hectares cultivated by 7, 000 farmers who are located within 30 km of the oil palm mill in GOPDC estate (Ofosu-Budu & Sarpong, 2013). In addition, the district has two agricultural research institutes; namely, the Oil Palm Research Institute (OPRI) at Kusi, and the Forest and Horticulture Crop Research Center at Okumanin. OPRI is the institution responsible for the production and supply of oil palm seed nuts to nurseries nationwide and offers other agricultural-support services to farmers in the districts. Apart from GOPDC operating as a major oil palm company in the district, the Kwaebibirem District Assembly has also acquired land in Abenaso and Amonom for oil palm plantation. The 24 hectares oil palm plantation is under the auspices of the President's Special Initiative (PSI) on oil palm (Kwaebibirem District Assembly, 2006).

The oil palm is also cultivated by independent small scale farmers who process or sell their produce to the estate farms. However, palm oil processing is largely carried out by small scale processors in the district. According to Tagoe et al. (2012) palm oil processing is one of the most organized household industries in the district. A large number of women work in the small scale sector of the oil palm industry as palm oil or kernel oil processors (Adjei-Nsiah et al., 2012b). In addition, some private individuals have extraction plants, where individual oil extractors process palm fruits and kernels (Kwaebibirem District Assembly, 2006). Kwaebibirem District was chosen as the focal study area because of the presence of major actors who form the oil palm value chain. Therefore, it was easy to trace the chain of activity from the production of the oil palm seed nuts to its ultimate consumption. In view of this, conducting the study in the

Kwaebibirem District was appropriate to address the overall objective of the study. It was possible to apply the findings on the validity of value addition in the oil palm industry to agriculture productions in Ghana because the district possesses pertinent characteristics of agriculture as described in preceding paragraphs of this subsection.

3.2 Research Methodology

The research methodology outlines sequence of activities by which the study was carried out. It also justifies the selection of data collection methods and instruments that were used to analyze the primary data.

3.2.1 Research Design

A case study design was adopted for the study because of the need to make detailed and intensive study on variety of issues that pertains to the oil palm industry in the Kwaebibirem District. This is because case study design brings out the complexity and particular nature of a case in question. This research design also allowed for the use of qualitative and quantitative methods in the study.

3.2.2 Research Strategy

The research strategy adopted for the study was a methodological triangulation also known as mixed method. This involves a mixture of qualitative and quantitative methods at different stages of the research process (Creswell, 2002). The quantitative method used in the study was a questionnaire survey. Quantitative method was adopted for the study to help establish linkages between some variables which were considered necessary for increasing income. Quantitative method also helped to establish the generalized theory that value addition in agriculture increases income and other multiplier effects in the case of Ghana. The quantitative method through questionnaire

based survey was targeted at many respondents which helped to generate statistics to permit generalization of results. However, qualitative method has its own strengths, which could not be met by the quantitative method. As such, qualitative method based on interviews, focus group discussions, and observation was also used in the study. The application of this method was necessary to generate and consider issues which were not included in the questionnaire. The use of qualitative method helped to investigate the chain of activities in the oil palm industry and the perception of producers on value addition strategies in relation to its effect on socio-economic development. The reason for choosing mixed method in this research is because one method could not bring out all the dimensions of the concept of value addition in oil palm industry. This is because each method has its strengths and weaknesses; thus, the need to combine both qualitative and quantitative method which enabled elaboration and clarification of results from the two methods. Mixed method helped to validate results and provide a stronger evidence for a conclusion through convergence and corroboration of findings which enabled generalisation of results.

3.2.3 Information sourcing

3.2.4 Secondary data

Although most of the information used in the study drew from primary sources, secondary data was also used to understand: concepts, definitions, theories and empirical results. Specifically, secondary data was used to identify the profile of the oil palm industry and socio-economic challenges of agricultural producers. Information was obtained mainly from relevant literature such as publications, journals, books, articles, newspaper, policy documents and periodicals from: USAID, ACDI/VOCA, the World Bank, Ministry of Food and Agriculture (MOFA), Ghana Statistical Services (GSS), and

other agencies of the State. Also, secondary data sources were valuable in designing questionnaires for the study and to supplement responses from the survey.

3.2.5 Primary data

Regarding primary data collection, the survey instrument was a questionnaire for palm fruit and kernel processors. The questionnaire was constructed based on previous interviews, field visits, and review of literatures on oil palm. In addition, a review of both published and unpublished reports on the oil palm industry, value addition in agriculture and socio-economic development was made as a prelude to the design of the questionnaires. A semi-structured questionnaire was designed because closed-ended questions were used to find out how many people were involved in productive processes whereas open-ended questions were used to find out about the perception of respondents regarding such issues. This combination created the possibility of finding out how many people participated in an activity and their opinions as well. In addition, primary data was also generated with an interview guide and a focus group discussion guide from key informants. Observation notes, photos, maps were also collected from the field as primary data.

3.2.6 Sampling Unit

In the Kwaebibirem District, the communities are located along major trunk roads and this is where most of the palm fruits and kernel processing mills are found (see figure 1.1). Table 3.1 provides a summary of some of the major communities and the number of mills in each of these communities. Despite the fact that there are numerous processing mills in each community in the study area, five communities were purposely selected for the study and these are Kusi, Kwae, Kade, Subi, and Asuom. The selection is based on the fact that Kusi is close to the Oil Palm Research Institute (OPRI); Kwae is also close

to the Ghana Oil Palm Development Company (GOPDC); Asuom is also within the GOPDC production area and a medium scale processing mill, Serendipalm Company Limited at Asuom also buys value added organic palm fruits from farmers; Subi and Kade (district capital) are at intermediary locations in the study area. Consequently, since the study communities are close to these institutions it was necessary to find out how they were influencing value addition practices in these communities. Furthermore, the number of palm fruit and kernel processing mills were substantial to conduct a survey in these communities.

3.2.7 Population

The population of the study was made up of palm fruits and kernel processors, kernel oil processors, oil palm nursery operators, oil palm farmers, and staffs of: Oil palm Research Institutes (OPRI), Serendipalm Company Limited, Ghana Oil Palm Company (GOPDC), and Kwabibirem District Assembly. In the small scale oil palm mill, some people work as local soap makers, food vendors, mechanics, traders, metal fabricators, and machine operators. Other workers in the small scale mill are mechanics, drivers, truck pushers, and fresh fruit bunch splitters, the aged, children, and exporters of palm and kernel oil. All these actors were part of the study's population.

Communities	Palm oil mills	Palm kernel mill	Total number of mills
Kade	7	3	10
Subi	7	2	9
Adankrono	2	-	2
Kusi	7	3	10
Takrawase	12	-	12
Abaam	3	-	3
Abodom	9	-	9
Abompe	5	1	6
Daman	5	1	6
Asuom	8	2	10
Nkwantan	2	1	3
Otumi	5	1	6
Anweam	7	-	7
Kwae	8	1	9
Otumiasika	3	-	3
Kumanin	4	-	4
Pramkese	6	-	6
Total	106	15	121

Table 3.1 Distribution of mills in Kwaebibirim District

Source: Author's field survey, March 2014

3.2.7.1 Sample Size determination

International Fund for Agricultural Development (IFAD) cited in Dauda *et al.* (2013) formula for sample size determination was used to determine the sample size of oil palm processors in the Kwaebibirem District (see appendix 4). The IFAD formular shows that 138 respondents were supposed to be sample for the survey but only 110 questionnaires were administered to small scale processors. This is because the rest of the processors

were not ready to participate in the survey owing to the fact that the study was conducted in the peak season (February to April) where palm fruits were in abundance and processors were in active production.

3.2.8 Quantitative process

3.2.8.1 Sampling Procedure

The snow ball sampling procedure was used to make a list of all the processing sites in the study area (Table 3.1 & 3.2). With the snowball method, existing groups of processors made referrals to other processing mills in the communities. After that stratified sampling, simple random sampling, and systematic sampling was used to sample 110 respondents who were palm fruit and kernel processors in the study area. First, stratified sampling was used to divide the population of the study into two groups, where members of each group shared particular characteristics. The choice of this technique is guided by the fact that palm fruit and kernel processors have different characteristics in terms of the source of palm fruits and kernels, processing technologies and equipment, and marketing outlets. Therefore, each sub-group was treated as an ‘independent’ population with different proportions of 80 and 30 populations assigned to palm fruits and kernel processors respectively. The study finds disproportionate grouping necessary because the strata differ not only in size but also in variability. It was therefore reasonable to assign a larger sample proportion to palm fruits processors who were more variable in character and in size than palm kernel processors.

<u>Communities</u>	<u>Total mills</u>	<u>Palm oil mill</u>	<u>kernel mill</u>	<u>sampled mills</u>
Kusi	10	7	3	7
Kade	10	7	3	7
Kwae	9	7	2	7
Asuom	10	8	2	7
Subi	9	7	2	7
<u>Tota</u>	<u>48</u>	<u>36</u>	<u>12</u>	<u>35</u>

Table 3.2 Distribution of mills in selected communities

Source: Author's field survey, March 2014

In each of the five selected communities, simple random sampling method was used to sample five palm fruit processing mills and two kernel processing mills. This was made from of a list of palm fruits and kernel processing mills in each of the selected communities. In addition, 22 respondents were proportionally sampled from each community. Subsequently, the 22 respondents were divided proportionally among the two different processors in each community. Thus, using the total number of mills in the communities, a ratio of 3 mills to 1 respondent was used and this resulted in 16 respondents being sampled from five palm fruit processing mills and 6 kernel processors were also sampled from two kernel mills from in each community. Subsequently, 3 respondents were sampled from each mill. This was made possible with the aid of the systematic random method to draw three respondents. In the mills, every processor owned a shed and so with the systematic sampling method, the total number of sheds in a mill was calculated and every nth shed was selected. The questionnaires were then administered to a processor in the shed (Table 3.3).

Communities	Number of sampled kernel mill	Number of sampled palm fruit mill	Number of respondents sampled in each mill	Number of palm fruit processors sampled	Number of kernel processors sampled	Total number of respondents from each community
Kusi	2	5	3	16	6	22
Kade	2	5	3	16	6	22
Kwae	2	5	3	16	6	22
Asuom	2	5	3	16	6	22
Subi	2	5	3	16	6	22
Total	10	25		80	30	110

Table 3.3 Distribution of total number of respondents sampled in the selected communities

Source: Author's field survey, March 2014

3.2.9 Qualitative process

Owing to the fact that the questionnaire based survey did not allow respondents to delve much into issues being addressed, a semi-structured interview approach was applied on some selected processors and key informants to determine the character of activities that generate value in the oil palm industry. This helped to derive a detailed view of the character of the activities that generate value in the oil palm industry. Hence, the first component of the qualitative research was based on two focus group discussions at Subi and Asuom. According to Teye (2012), focus group discussion is very good for generating detailed information on experiences, perceptions, emotions, beliefs and behaviors of respondents. At Subi, the participants for the group discussions were kernel processors and palm fruit processors at Asuom. It was necessary to adopt this research strategy because after administering the questionnaires to respondents, it was realised that there was the need to delve more into value adding marketing, pricing, distribution of products and other processing related issues.

The second component of the qualitative process was a non-participant observation. This was included in the study to sufficiently address objective 1. Observation helped in examining current processing activities and practices in the oil palm value chain so as to cross check and substantiate the responses from interviewees. Observations were therefore made for a period of two weeks.

The third component of the study was a semi structured interview for elites and technocrats to acquire value addition information from upstream to downstream. Semi structured interviews were conducted with 5 staff members of GOPDC comprising of the Director of Agriculture, Nursery Manager, Estate Manager, Mill Manager, and the Manager of Quality Control and Assurance Unit. At OPRI, 5 staff members, each from: the Plant Breeding and Seed Production unit, nursery unit, Agronomy and Physiology section, and Pathology section, commercialisation and information unit were interviewed. In addition, 3 staff members of Serendipalm Company Limited were also interviewed on organic value addition in the oil palm production. At the district assembly, the heads of the departments of: Ministry of Food and Agriculture, National Board for Small Scale Industries (NBSSI), and Planning Unit were interviewed to elicit their opinions on issues related to policy and support for value addition in agriculture.

Fourthly, instead of administering questionnaires to farmers, 6 farmers were interviewed because some farmers were presumed to be processing palm fruits. In addition, 5 nursery operators, 4 traders, 2 kernel oil producers, 5 kernel processors, and 2 palm fruits processors were interviewed from the five communities

3.2.10 Methods of Data Analysis

The study used descriptive statistics like the pie charts, bar charts, and frequency distribution tables to analyse information generated from the field. In addition, mean,

mode, and percentages were used to address objective 2 of the study. In doing this, the study evaluated the processes of adding value and its effects on the socio-economic status of processors. Statistical Package for Social Scientists (SPSS) version 20.0 was used to generate descriptive statistics, test for correlation, conduct T-test and multiple regression analyses among some variables. Qualitatively, aggregate responses from respondents were coded and analyzed by examining the responses under themes in relation to the research questions and objectives of the study.

3.2.11 Measurement of Value Addition

The study used the net profit approach to compute the value added to the processed fruit (see appendix 5). The value added in this case is the amount of profit generated by processors after deducting all the cost incurred in processing one tonne of palm fruit and kernel in the Kwaebibirem District.

3.2.12 Pearson Correlation Analysis

Correlation refers to any of a broad class of statistical relationships involving dependence (Palmliden, 2014). A well-known phenomenon of dependence is the correlation between the demand for a product and its price. For example, as indicated above, there is a relationship between the demand for a product and its price such that more of the product is demanded at a lower price and vice-versa, all other things being equal. The most familiar measure of dependence between two quantities is the "Pearson's correlation coefficient" which indicates the strength of a linear relationship between two variables X and Y.

In this work, the "Pearson's correlation coefficient" is employed to evaluate and to test the relationship between value addition and employment in both the palm oil and kernel

processing industries. The population correlation coefficient $\rho_{X,Y}$ between two random variables X and Y with expected values μ_X and μ_Y and standard deviations σ_X and σ_Y is shown in appendix 6.

Where E is the expected value operator, cov means covariance, and, $corr$ a widely used alternative notation for the correlation coefficient.

Since a sample data was used, sample correlation coefficient was used to estimate the population Pearson correlation r between X and Y (see appendix 7)

where \bar{x} and \bar{y} are the sample means of X and Y , and s_x and s_y are the sample standard deviations of X and Y . The Pearson correlation is +1 in the case of a perfect direct (increasing) linear relationship (correlation), -1 in the case of a perfect decreasing (inverse) linear relationship and some value between -1 and 1 in all other cases, indicating the degree of linear dependence between the variables. As it approaches zero there is less of a relationship (closer to uncorrelated). The closer the coefficient is to either -1 or 1, the stronger the correlation between the variables.

3.2.12.1 Test of Significance of Correlation Coefficient

After estimating the correlation coefficient between any two variables X and Y , it becomes necessary to test for the significance of the correlation coefficient obtained (i.e. the significance of the identified relationship). The following hypothesis is used to test the significance of the correlation coefficient (ρ) (see appendix 8)

The sampling distribution of ρ is approximately normal (but bounded at -1.0 and +1.0) when the sample size (n) is large. However, it is distributed as t when n is small. The simplest formula for computing the appropriate t value to test significance of a correlation coefficient employs the t distribution (see appendix 9).

3.2.12.2 Comparing Means of Several Groups

One of the desires of this work was to ascertain whether the mean income levels were the same or perhaps, significantly different according to some factors of production such as type of oil produced, type of fruit used for production and the educational levels of producers. These variables (or factors) had several levels. For example, a factor such as educational level had four distinct levels, namely: primary school, junior high school, senior high school and non-formal education. Each level of any given variable could be taken as a distinct group.

3.2.12.3 The ANOVA Procedure

To undertake this test, the omnibus F-Test is used to test for a significant difference at the different levels of the factors/variables. To be sure that the assumptions underlining the F-Test such as the normality of the different levels of the variable and the equal variance assumption is not violated, the researcher looked at the normal quintile plot of each level. By so doing, it was realized, in each case, that, the data points fall close to the line which implies normality of the responses on the levels of the factors. Also the standard deviation of each level or group was calculated to be sure that the ratio of the largest to the smallest group's standard deviation was not more than two (see appendix 10).

This measures the variability of each observation around its group mean.

From the above notations and the size of the sample taken, one will observe that the computation of the F-statistic is going to be very tedious and time consuming; hence the Statistical Package for Social Sciences (SPSS) will help us do this. The SPSS will generate an analysis of variance (ANOVA) table as shown in appendix 11.

At a given significant level, if F^* is large, meaning the variability between the groups is large relative to the variability within the groups, the null hypothesis of equal means is rejected. Alternatively, if F^* is small, which implies that the variability between the groups is small relative to the variability within the groups, the null hypothesis is not rejected.

The criteria for the test are, thus, to reject the null hypothesis (H_0) if $F^* > F_{\alpha, k-1, n-k}$ and to fail to reject H_0 if otherwise. It is worth mentioning that the level of significance (i.e. α) for all ANOVA test in this work is set at 5%. The significance probability (*p-value*) can as well be used to make valid conclusions on the hypotheses above. In this case, the criteria are to reject the null hypothesis (H_0) if *p-value* ≤ 0.05 and to fail to reject H_0 if otherwise. Let me be quick to add that, all the conclusions made on the hypotheses in this work have been based on the *p-value*.

3.2.13 Summary

The first section of this chapter discussed characteristics of the study area. The second part, discussed the data collection methods adopted under the following themes: the research design and strategy, data sources, sampling technique, sample size, and analysis of quantitative and qualitative data. Analysis and presentation of results on data generated from field study is carried out in the next three chapters.

CHAPTER FOUR

VALUE ADDITION ACTIVITIES IN THE OIL PALM INDUSTRY IN KWAEBIBIREM DISTRICT

4.0 Introduction

This chapter determines the character of activities that generate value along the chain of production and service delivery in the oil palm industry. To achieve this objective, the study drew from the value chain theory to demonstrate the linkages among actors, flow of resources, networks and how actors add value in the chain. Subsequently, in-depth interviews, observations, group discussions and secondary data were used to collect information on this purpose. The activities in the oil palm value chain (VC) were grouped into upstream production, midstream processing, and downstream commerce.

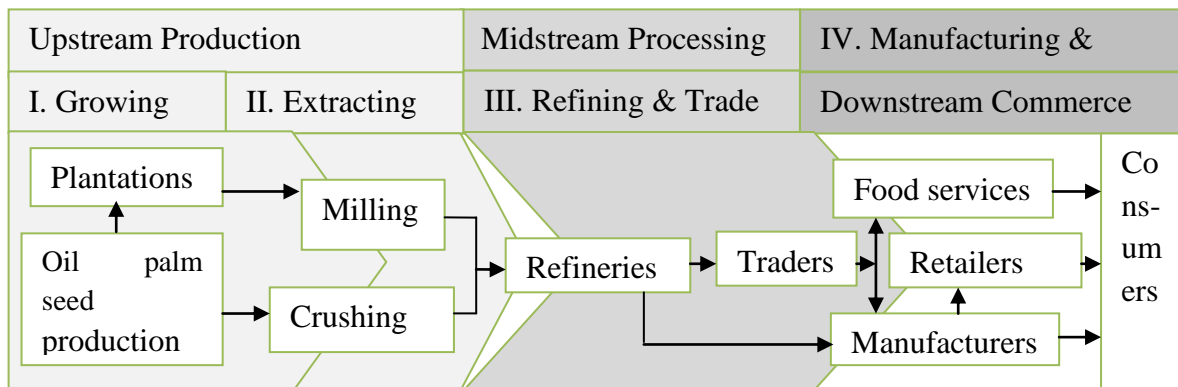


Figure 4. 1 A Diagrammatic Representation of the Upstream, Midstream and Downstream Activities in the oil palm industry

Source: Adapted from the Malaysian Oil Palm Council (2009)

4.1 Upstream Production

Upstream productions consist of series of activities that leads to the production of crude palm oil (CPO) and crude kernel oil (CKO). Primarily, these are input value addition activities ranging from research, seed production, nursery, cultivation and harvesting.

The main actors in this stream of production are Oil Palm Research Institute (OPRI) of the Council for Scientific and Industrial Research (CSIR), Ghana Oil Palm Development Company (GOPDC), individual nursery operators, smallholder farmers, palm oil processors, kernel processor, kernel oil producers, and traders. Upstream production is based on research activities which results in the production of improved planting material.

4.1.1 Research

In Ghana, OPRI of the CSIR at Kusi is the only institution responsible for conducting research, aimed at improving the quality of oil palm seeds. *“This means that the seeds are at a particular stage of production but the aim of research activities is to improve upon the breeding capacity of the oil palm into high yield varieties”* (Head of breeding, 25/03/2014, OPRI-Kusi). This activity, according to Chege (2012) citing Eathington *et al.* (2000), begins value addition in agriculture because innovation derived from research leads to the production of seeds that are able to boost farmer’s income.

Research shows that there are three main cultivars of the oil palm for commercial productions. These cultivars are based on the structure of the fruit, mesocarp, shell and its commercial value. They include: ‘dura’, ‘pisifera’, and ‘tenera’. ‘Dura’ variety has a thick shell of about 2-8 mm thick, low mesocarp (20-65%) a medium mesocarp (20-65%) and a hardy variety. Though, it is less productive in terms of yield of palm oil, its thick endocarp ensures good supply of palm kernel oil when processed. ‘Pisifera’ is a shell less variety with a thick mesocarp which makes it a viable source of oil. ‘Tenera’ variety is obtained by crossing ‘dura’ and ‘pisifera’ variety. ‘Tenera’ is locally called ‘agricabe’ and it has a relatively medium shell and mesocarp. Although ‘pisifera’ variety has a thick mesocarp which is indicative of high oil yield, ‘tenera’ variety is preferred for

commercial cultivation because 'pisifera' is susceptible to fruit abortion (Verheye, 2002).

Research activities at OPRI include assembling varieties of oil palm cultivars from different parts of the world at the research station. This is followed by carrying out trial exercises by crossing different cultivars. The aim is to study characteristics such as: the amount of oil yield, bunch yield, and height of oil palm. Other characteristics that are of interest include the number of leaves, drought resistance and vegetative growth of the crop. The crop with a high ranking according to the features stated is used for commercial production.

The production of seed for commercial planting is also carried out by OPRI based on controlled cross pollination of female inflorescences on selected 'dura' palms with pollens grains collected from selected 'pisifera' palms. The oil palm has a primodium with the potential to produce a male or female flower and this makes the oil palm a monoecious crop. The female florescence is where fruiting occurs and it consist of a central stalk to which spikelet are attached. The spikelet contains 1 cm cream-coloured female flowers with three sepals and petals (Coley & Tinker, 2003). When male florescences of 'pisifera' cultivars are crossed with female pollen grains of a 'dura' palm, it results in the production of fruits which are of 'dura' type. However, oil palms raised from such seeds will produce thin-shelled 'tenera' fruit. Accordingly, a 'tenera' palm tree is able to produce 18-22 tonnes of fresh fruit bunches (FFB) per hectare annually. After producing 'tenera' fruits from the 'dura' tree, the bunch is harvested to a section where it is split from the stalk. The individual fruits are removed from the spikelet and the mesocarp is removed with a depulper. The nuts are subsequently arranged in a tray in a drying room for some period before they are transported to a cold room where temperature is kept to about 24⁰C-25 ⁰C. The oil palm seeds go through a period of

dormancy for several months to many years; hence, OPRI germinates the seeds in commercial quantities for farmers.

Seeds are germinated with the “dry heat method” to stimulate oil palm seed nuts. Afterwards the seed nuts are soaked in water until they attain 17% moisture content. They are subsequently heated for several weeks (70 days) at 39-40 °C. This is followed by soaking the seeds in water again until they attain a moisture content of 22 %. The first signs of germination are seen about ten days after the second soaking. Germination is usually completed in about six weeks (Head of Breeding Unit, 25/03/2014, OPRI-Kusi).

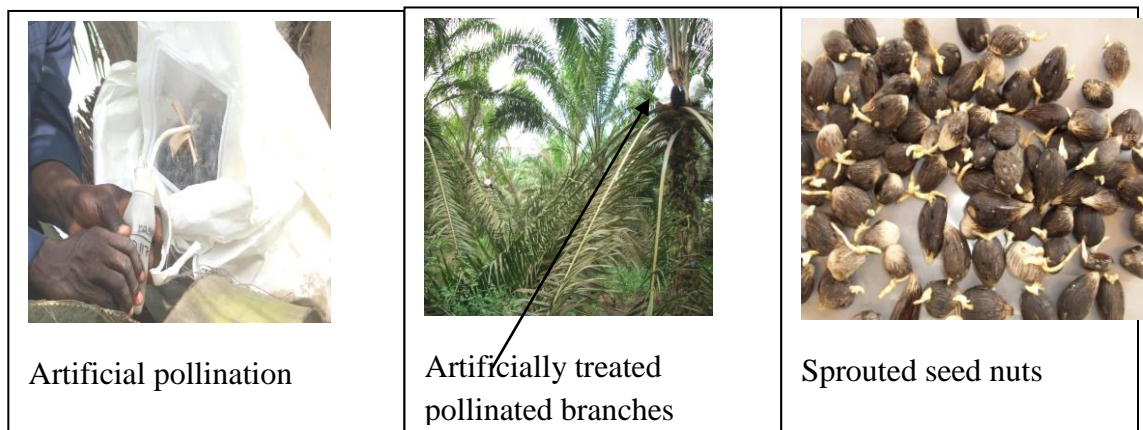


Figure 4. 2 Artificial Production of ‘Tenera’ Seed Nuts at OPRI

Source: OPRI Management, March 2014

The germinated seed nuts are packed numbering hundred in a sachet. A total of 10 sachets of 100 seed nuts are packed in a carton for sale at a cost of GH¢150 (\$ 57.44). Currently, OPRI has the capacity to produce 5million nuts per annum under the joint operation with Ghana Sumatra Limited. This joint enterprise shows how bilateral and multilateral trade agreements shape value addition in the oil palm industry. The seed nuts at the germination center are sold directly to farmers or commercial nursery operators. In addition, OPRI raises some of the seed nuts in its nursery in commercial quantities. As a result of its activities OPRI has four research sections which comprise the Plant Breeding

and Seed Production section, Entomology section, Agronomy and Physiology section, and Pathology section. Research findings on the oil palm from these departments are linked to Agriculture Extension Service workers and farmers by organizing workshops and training programs (Head of commercialisation and information, 26/03/2014, OPRI-Kusi). These input value addition strategies are to ensure that farmers are provided with good information and planting materials so as to lay a strong foundation for the production of the oil palm.

4.1.2 Nursery

In the oil palm VC, the next point for adding value is the nursery. Generally, seed nuts are raised in commercial quantities by GOPDC, OPRI and individual nursery operators. The seed nuts are raised first in a prenursery; however, before this is done, polythene bags are filled with clay-loam soil, top soil, sifted forest soil, or sandy topsoil. Polythene bags of 250 gauges or 25cm x 25cm flat sizes are preferred at this stage. Subsequently, two leave seedlings are sent out from the distribution center as bare root seedlings packed in rubber sachets and planted first in a prenursery (Nursery Manager, 17/03/2014, GOPDC). The germinated seed is placed in the center of the bag with a hole made with the finger to about 2.5cm deep. GOPDC and OPRI operate prenurseries in greenhouses but nursery units owned by individuals are operated in open fields; hence, weeds or palm fronds are used to provide sheds for young seedlings. After two weeks, the shed may be removed when the leaves begin to grow provided overhead irrigations are installed or water supply is adequate (Interview with Mr. Asare, Nursery operator, 23/03/2014, Kade town).

The primary requirements for maintaining steady growth after the emergence of the first leaf are adequate watering, hand weeding and balance supply of fertilizer. The frequency

of water supply depends on the amount and frequency of rain fall. In the dry season, twice daily watering is done at a rate of 1 of 18 litre watering can per 2m² of bags in individual nursery units (Interview with Mr. Ntim, 25/03/2014, Kade town) but GOPDC and OPRI uses polythene tubes supported 1m above the seedling with spray nozzles.

The seedlings are ready to be transferred to the main nursery when they have grown about 4-5 leaves or they are 3 months matured (Interview with Uncle Joe, Nursery attendant, 26/03/2014, OPRI-Kusi town). The small bag is torn and placed in a hole dug in a big polythene bag and soil consolidated around it. In the main nursery, value is added to the seedling through mulching. With this method, polythene bags are filled with finely divided bunch refuse, sawdust, palm shell, groundnut husk or other fibrous material. In GOPDC nursery, empty fruit bunches are spread in interrows between poly bags to prevent soil erosion. In Individual nurseries some farmers mix composted empty fruit bunch from the mill autoclave with soil. Effluent solids and decanter solids are also mixed with soil in the plastic bags to enable the seedlings to gain nutrient (Interview with Mr. Asare, 22/03/2014, Kade town). Weeds and pests, such as the snail, grasshopper and night flying beetles are controlled by hand collection. Some nursery operators use organic materials for mulching and enriching the soil. This is carried out to meet the demands of customers who are into organic farming (Interview with Mr. Chris, 20/03/2014, Asuom town). This activity corresponds with Maetzold's (2000) cited in Lewis (2002) concept of value addition in agriculture which involves special ways of productions for a specific market.

In a situation where the soil is fertile like a forest top soil, then fertilizers are not used. However, when such soils are not available, farmers apply a solution of 2 Oz of ammonium phosphate in four gallons of water per 4m² of bed every week but when sulphate of ammonia is used, it is applied every two weeks (Interview with an

Agronomist, 25/03/2014, OPRI-Kusi town). Seedlings are raised in the nursery for about 8-12 months before they are transplanted to the farm. The nursery manager at GOPDC explains that: *“the essence of all the value addition activities in the nursery is to lay a strong foundation for the cultivation of the oil palm on the farm”*. In the small scale sector, the operation of a nursery is a lucrative business run by some individuals. This is because value addition services such as selling of oil palm seedlings in plastics, farmers markets, and planting services are offered to customers. In an interview a nursery operator indicated that:

“I sell the seedlings to NGOs, companies, and farmers. Every season, I sell about 1500 seedlings to ADRA, a company in Accra and to other parts of the country like Pretsea, Takoradi, Goaso and other areas in the Western region. Last year, I sold a seedling for 3 GHs but it is likely that I will increase the price this season to GH¢ 3.50 pesewas (\$ 1.34) or GH¢ 4 (\$ 1.53). I sell about 10,000-20,000 seedlings annually” (Interview with Mr. Asare, nursery operator, 22/03/2014, Kade town).

The various mode of production enhances the value of an agricultural product and these activities, according to USDA (2002) are value addition strategies.

4.1.3 Production

After marketing transactions are completed in the nursery, seedlings are transplanted to the farm or plantations. This activity is usually done in March that is, at the beginning of the rains up to the month of May or June. The primary purpose of growing oil palm is to generate oil; hence, to achieve this aim, value addition activities such as: preparation of land, land demarcation, cutting of pegs, layout of roads and planting blocks are undertaken on the farm. Also, where the trees are located on lowlands with a lot of soil moisture, they tend to grow well in height and produce more FFBs. Hence, upland areas

are well graded to enable soil moisture retention. Other value addition activities that are carried out before seedlings are transplanted include: under bushing, lining, platforms and terracing, holing, tree felling, clearing of paths, and tree burning among other preparatory exercises. Lining and pegging is then carried out to form a triangular pattern and seedlings are planted 8.8m x 8.8m in the form of a triangle. The inner lining is carried out to help mechanisation of activities on the farm. The oil palm requires protection from the activities of rodents such as squirrels, mice, rats, grass-cutters and other rodents. And so, farmers protect the oil palm seedlings by using wire mesh, discarded cans, bamboo pieces, cane, vane and palm branches around it meristem before transplanting to the farm (Interview with Nursery attendant, 26/03/2014, OPRI-Kusi).

The stakeholders involved in the production of the oil palm indicated that farmers undertake input value addition activities by: using agrochemicals; replanting oil palm when they are old; protecting crops; and weeding the farm. However, a study carried out by Adjei-Nsiah et al. (2012a) shows that small holder farmers use less innovative methods compared to the GOPDC. In addition, the company has an out grower scheme which integrate smallholder farmers into the oil palm value chain. Out-grower farmers are trained to acquire basic planting and farming skills. Through this initiative, farmers are equipped with the necessary planting materials to add value in their productive activities. Besides the out-grower farms, there are GOPDC-supported smallholder farms located on land leased by the GOPDC, which is an important feature of the nuclear/nucleus estate concept. This way, GOPDC is able to increase palm oil production because farmers are required to supply their FFB to GOPDC mill (Director of Agriculture, 17/03/2014, GOPDC-Kwae town).

Other value addition activities on the farm involve intercropping in small holder farms for the first 3-4 years. The main crop used for this purpose include: maize, banana,

plantain, cassava, and vegetables (Interview with Agronomist 26/03/2014, OPRI-Kusi town). Generally, small scale farmers use organic means to improve soil nutrient by adding fiber and potash generated in the mill to the soil. Some farmers supply organic palm fruits to Serendipalm Company Limited to produce certified organic palm oil for export. Hence, these organic farmers at Asuom, Abodom, Abaam, Tweapease, Kukubam, Pramkese, Subi, Damang and some other communities in the District are under contract to supply organic palm fruits to the company. Accordingly, organic matter such as: palm oil mill effluents (POME), empty fruit bunches (EFB), and fibers are used as fertilisers and for mulching the soil. *“Sometimes, the company supplies these materials to farmers from its processing mill. The EFB is applied at 100kg to 150 kg per tree and in older palms, EFB’s are applied at the rate of 40 tonnes/ha with the interrows”* (Agronomist, Seredipalm Company, 20/03/2014, Asuom town). Other materials observed include decomposed cocoa pods and cola husk, and poultry manure.

Another value addition activity which is essential to the growth of the oil palm is weed control. In the plantation, herbicides and tractors are used to carry out this activity. Small scale producers also adopt chemical and mechanical means to control weeds provided they have the means to afford these methods. They however, use manual labour to clear weeds on the farm at a fee of GH¢ 80 (\$ 30.63) per a labourer or use biological means of controlling weeds by rearing livestock on the farm. As the animals feed on the weeds, their droppings provide manure to the oil palm. Besides ring weeding, path maintenance and pruning of unwanted branches are carried out on the farm. Moreover, cover crops such as centrosema pubescences, pueraria phaseloides, and calopogonium mucunoides are planted on the farm to prevent erosion and runoff of soil nutrients during the rains. Some farmers spread palm fronds and old trunks on the ground to check erosion and add organic matter to the soil.

The oil palm may begin to bear fruit in 2–3 years depending on the planting material. Value adding activities described above are important because each contributes to the growth of the palm tree, maturity of fresh fruit bunch (FFB), size of fruit bunches and total oil yield by the crop. Once first fruits are harvested, subsequent fruits begin to grow at the apex of the crop. In addition, continuous harvesting results in the expansion of the trunk and height of the oil palm (Aunty Kate, 15/03/2014, Asuom town). On the whole, a good FFB is dependent on several factors and these include: place of planting, type of soil, cover cropping, and adherence to other production practices results in harvesting of more FFB (Scientist, Forest and Horticulture Crop Research Center, 27/02/2014, Kade town).

4.1.4 Harvesting and Marketing of Fresh Fruits Bunch

Harvesting of palm fruit takes place throughout the year but it is mostly done during the peak season. That is between February to May and the lean season, between September and December. The fruit grows in a bunch attached to the palm tree. Some farmers use a hooked knife attached to the end of a bamboo pole to harvest FFBs on tall palms. Other harvesting equipment are sickle chisels, wooden handle chisels and axes used on young palm trees until they are 12 years old or about 3.5m in height. Harvesting of FFB requires labourers to harvest, collect FFBs and loose fruits, and carry FFBs to the roadside at a fee of GH¢100 (\$ 38.29) for an acre of land (Mr Obeng Doudo, Farmer, 16/03/2014, Kwae town). Also, some farmers use simple vehicles such as trucks, tricycles and animal driven vehicles to ease the demand for labour in the oil palm industry (Interview with Mr. Yaw Atakora, 21/03/2014, Subi town). In GOPDC, the fruits are transported directly to the mill located in the estate. Farmers who operate under the GOPDC out grower scheme in communities such as Otumi, Anweam,

Damang, Abompe, Asoum, Atobriso, Nkwantan and other communities sell their FFBs at farm gate price of GH¢ 250 (\$ 95.73) and mill gate price of GH¢ 280 (\$ 107.22).

Independent smallholder farmers sell their fruits directly to GOPDC, medium scale companies, middlemen, small scale processors or institutions. Alternatively, market women purchase the fruits and sell it in urban or rural markets. Or fruits may be sold processed into oil by the farmer. In this case, the farmer-processor is involved in a value adding initiative (Evans 2012). These farmers may buy from others on condition that proceeds from their farms are not sufficient to generate the quantity of oil required. Small scale farmers use GOPDC's farm gate price to sell FFB to local processors. However, they operate a 'black or open market system' by selling FFBs at lower rates. In spite of the fact that some farmers sell FFBs at GOPDC farm gate fee, the system in operation between farmers and small scale processors does not recognize the use of scales to weigh FFBs. Thus, the small scale system operates by: using the 'eyes' to tell the tonnages of FFBs; bargain the prices of FFBs; and addition of some bunches to the quantity acquired which is locally called 'ntosoo'. In the trade between farmers and processors, 1 tonne of FFB is counted from 70-80 of FFBs and this is also done with regard to the size of the FFBs. Sometimes, FFBs are counted as 2 bunches equivalent to one bunch thus, 110-120 FFBs may be counted as 1 tonne. In some situation, medium size bunches are counted from 90 -100 as 1 tonne. Furthermore, the loose fruits collected are valuable for processing palm oil. This is because they contribute to the total yield on the farm. A farmer processor indicated that:

“With the loose fruits, you will not hire labour to split and remove the fruits from the spikelet. The loose fruit is also valuable because the fruits which falls out on the ground are the first fruits at the upper parts of the bunch and these are usually

big with a lot of oil than those at the base of the FFB which are usually yellowish in colour with low oil content” (Auntie Comfort, 19/03/2014, Subi town).

The assertion that loose fruits were valuable was also supported by the Estate manager at GOPDC who explained that, the FFB consist of stalk, spikelet and other yellowish materials in the spikelet and all these are waste to the processor. As a result, loose fruits cost more than 1 tonne of FFB. A jute sack or size ‘34 bucket’ is used for measuring the loose fruits. A sack costs GH¢30 (\$ 11.48) and one bucket cost GH¢10 (\$ 3.82) (Bra Kuoku, 20/03/2014, Asuom town).

Every processor establishes a relationship with farmers and this is based on commitment, friendship, trust and good communication with a particular farmer. According to Boehlje *et al.* (1999), this type of relationship is very vital for building a productive value chain. This is important because during the peak season, palm fruits are in abundance; hence, farmers have few buyers. Even though farmers sell most of the fruits to processors at a lower rate and are aware of the advantages of the standard scale, farmers prefer the local system because of the advantages involved. A farmer expatiates:

“The women pay us in cash but the companies pay farmers after 2-3 weeks of buying the FFB in the peak season. However, there are times that processors pay us in advance when competition for fruit is high and so we are able to use the money to pay our labourers. During the lean season, the companies raise the price of FFBs and pay in cash so most farmers sell to the companies. Thus, some farmers fail to deliver FFBs to processors but during the peak season, we sell to the women. Moreover, there are times processors give us loans which we repay by supplying them with palm fruits and this is not done by the companies. So, I am

bound to sell to the processor irrespective of the season just to pay back in kind”

(Mr. Obeng Doudu, 15/03/2014, Kwae town).

In short, the networks flow of resources, marketing strategies, and innovation in the production activities are various forms of value addition activities (Ernst & Wood, 2011) and these activities have various implications on the oil palm VC.

4.1.5 Spatial and Social Organisation of Processing Palm Fruit

The extraction of oil involves milling of the palm fruit to generate crude palm oil and crushing of the kernel to obtain crude palm kernel oil. Generally, there are three categories of palm fruit processors; this categorization is based on the amount of fresh fruit bunch processed, mode of processing and target markets of each processor. The largest oil palm processing mill in Kwaebibirem District is owned by GOPDC, followed by some medium scale mill run by different companies including Oro Oil Mill, Obooma Company limited, Serendipalm Company Limited, Joe’s Oil Mill, WAML Company Limited among others and numerous small scale processing mills. With the exception of Obooma mill, most of the medium scale companies were operating under the State’s Free Zone Scheme. It shows how the State is contributing in the form of policy to value addition in the oil palm industry. On the basis of the quantity of fresh fruit processing, the large scale mill processes 5 or more tonnes of FFB/hr at 95-100% extraction rate, medium scale mills processes 1-4 tonnes of FFB/hr at 75-80% oil extraction rate and small scale mills have the capacity to process less than 1 tonne of FFB/hr at an oil extraction rate of 50-60% (Poku, 2002).

Small scale mills show great spatial dispersion, with virtually every town having numerous mills. Small scale mills in Kwaebibirem District are referred to as ‘krama’ a term derived from the name of a German who was the first person to have used a

mechanized technology to process the palm fruits in the district (Mr. Anarfi, 27/03/2014, Kusi). The mills are located near wetlands or waterlogged areas, dump sites and outskirts of some communities such as Kade, Asuom, Subi, Kusi and Kwae. Perhaps the reason for the different locational pattern is because processing activities demands for: a lot of space; generates smoke; heat and waste into the natural environment; and difficulty involved in accessing land. Even so, there are instances where some mills are also located within the communities. In some communities like Kwae, Subi and Kade, palm and kernel processors were clustered at the same mill. In addition, most of the small and medium scale mills were located along major trunk roads in the district. Consequently, there were many processors working in a mill and each processor has a shed where they heap FFBS and keep other processing materials. In GOPDC, the mill is located in the farm estate at Kwae. However, FFBS were transported from the Okumaning plantation and out-grower farms to the mill.

The locational distribution of mills in Kwabibirem District may also be explained from economic perspective with Von Thunen (1826) theory on the location of agricultural activities in his 'Isolated State'. Von Thunen (1826) assumed that: The city is located in an isolated State surrounded by an unoccupied wilderness; the land of the State is completely flat, with no rivers or mountains and soil quality and climate are consistent; farmers in the isolated State transport their own goods to market via oxcart across the land; and farmers act to maximize profits. He later relaxed this assumption somewhat, by introducing a navigable river or canal, by which transport costs are less than by overland cart. He also considered the effects of such things as mountain barriers and import duties upon the costs of moving goods. Thus, distance is thought of as economic distance, not merely physical distance; it is the cost incurred and not the distance in so many kilometers which matters. Von Thunen also abandoned the assumption that there is a

single city by introducing a subsidiary city. Finally, modification on the role of trade restrictions, subsidies and taxes were made. All of these, to greater or less extent, affect the prices of products; hence, upon locations of production. Von Thunen hypothesized four pattern rings of agriculture activities around the city.

1. Dairy and intensive farming occur in the ring closest to the city because vegetables, fruits, milk and other dairy products must get to the market timely.
2. Timber and firewood are very heavy and difficult to transport so they are located in the second zone.
3. The third zone consists of extensive field crops such as grains.
4. Ranching is located in the final ring surrounding the central city.

Even though assumptions in Von Thunen's theory are not the same as patterns of oil palm activities in Kwaebibirem District, it is an important theory that can be used to explain the location of oil palm activities. It is an excellent illustration of the balance between land cost and transport cost. The oil palm farmer knows the price of palm fruit from the farm gate. This then, is the local price at the farm buildings, which form the central of operations for the farm. The fields which lie far away from these buildings incur higher costs of operation than do the nearer plots, on account of greater amount of time spent in travelling back and forth. If the distance is sufficiently great, there will be no profit in cultivating the oil palm far away from the communities. Furthermore, the intensity with which the oil palm is grown will decline as the distance from the communities increases considering factors such as poor transportation route and fuel prices. Oil palm farmers may consider the cost of cultivating the field and returns obtained from it and try to locate processing mills within the communities so that the net obtained from each field is maximised. The distance from communities at which the oil palm ceases to be grown is affected by the distance within the farm from the

communities at which it is grown. At greater distances from the community, the economic rent yielded by the oil palm will be less, but farmers may choose to compensate for this by reducing their production costs. This they could do by growing the oil palm by not: weeding the farm, applying agrochemicals, and employ less labour or lower the selling price of palm fruit. In this way, the farms could be extended somewhat beyond the limits it would otherwise have.

As one gets closer to the communities, price of land increases, so this theory also explains why some small scale mills were located at waterlogged areas and at the outskirts of most of the communities in the district. The farmers of the 'Isolated State' balance the cost of: transporting goods to the city; the cost of land; and profit by producing the most cost-effective product for the market. In the case of Kwaebibirem District, it can be explained that the location of oil palm processing mills is a strategy of sustaining the energy of oil palm farming which surrounds most of the communities. The location of mills in the district provides ready market for palm fruits. Secondly, the palm fruit is bulky and cumbersome to transport; hence, the presence of mills in the oil palm belt, thirdly, palm oil quality depends mainly upon the rapidity with which fresh fruits is processed, and furthermore, the oil extraction process entails the loss of considerable weight, it is most economical to carry out processing near source of raw material. Hence, the concentrations of the small scale mills within the oil palm belt.

The spatial distribution of the mills as shown on figure 4.3 is a concentration of the mills almost along the major truck roads in the district. The specific location of the mills along trunk roads may also be as a result of the bulky nature of the palm and kernel oil, palm kernel, transportation cost, and easy accessibility to customers. With regards to the location of some palm fruit and kernel mills at the same place, it was observed that palm kernel processors did so to their advantage. Basically, they benefited from economies of

scale such as: easy access to palm kernels especially in the lean season; avoidance of transport cost; easily access to market and equipment. It shows that agents acts in their own self-interest. Therefore, oil palm processors will choose locations that will maximize their profit. This observation was discovered to be true when a palm fruit processor indicated that: *“those of us who have our mills far away from the main roads find it difficult to access market for our goods especially during the peak season. When customers come to us, it is only because they were referred to our mill by those operating in mills along the main road”* (Aunty Ewurajoa, 17/03/2014, Asuom town).

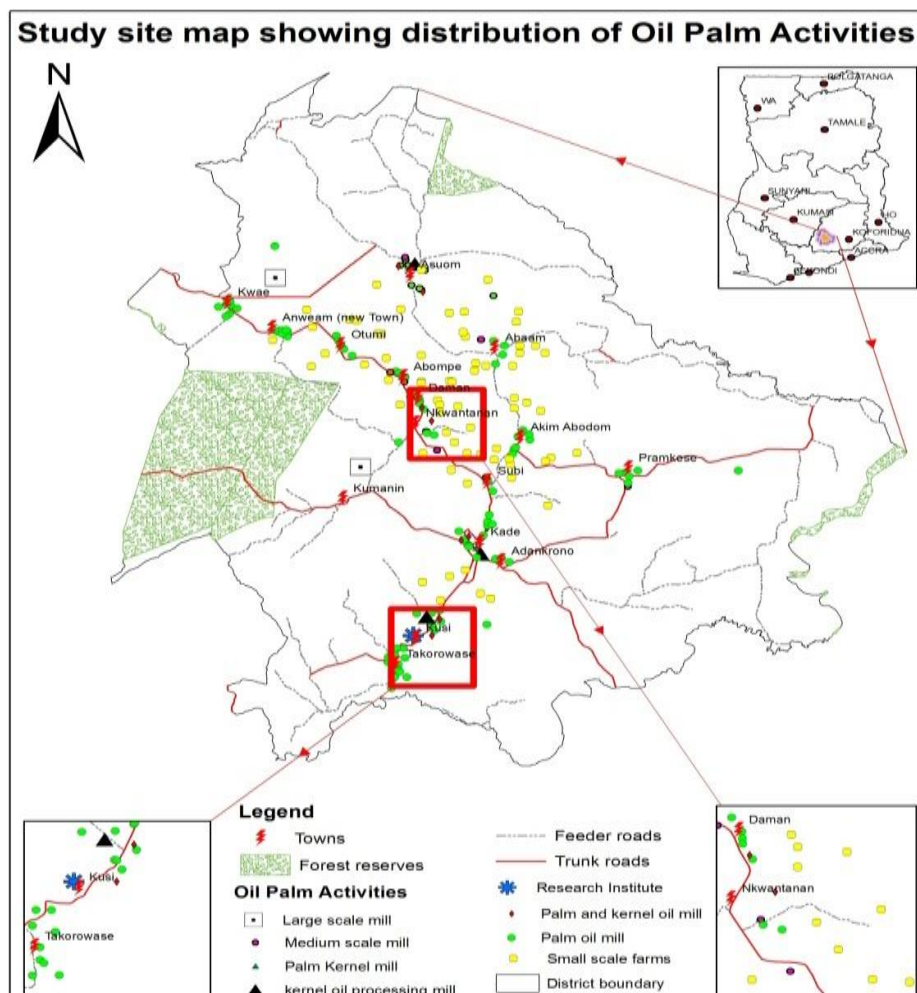


Figure 4. 3 Locational Distribution of Palm and Kernel Mills in the study area

Source: Author's field survey, March 2014

In addition, oil palm farms are located close to the communities, the radius beyond which it is considered uneconomical to obtain fruits because of high transportation costs and loss of fruit quality arising from increased evacuation difficulties. This shows that oil palm farms are occupying land areas immediately surrounding the towns in the district. The primary element that can be deduced from the behavior of oil palm processors is the need and desire for interaction between places which in this case may be with other mills, farms and marketing centers. This may result in a pattern of movement which may resemble a geometric pattern of straight lines between points, but the fact is, most movements are channeled along major routes, such as roads. So, it can be observe on figure 4.3 that the patterns of channels together with nodes form networks. These patterns are not static but are subject to change in time by spatial diffusion of innovation in other mills or by the evolution of other economic activities as suggested by Hägerstrand (1953).

4.1.6 Stages in the Processing Palm Fruits by Small Scale and Large Scale Sector

The ensuing discussion on the stages of adding value to the palm fruits and kernels through processing focuses on the GOPDC and small scale processors whose basic characteristics have been summarized in section 4.1.5. After fruits are harvested and all the necessary arrangements are made, as described in section 4.1.4, the FFBs are transported to mills usually by two men accompanying a driver who may help in offloading the FFB with a metal pin. In GOPDC, FFBs are inspected and weighed before FFBs are offloaded into a ramp. In the small scale processing mill, fruits may be left for about 3-5 days before splitting FFBs. At GOPDC, fruits are processed within 48 hours because quality oil with low FFA content is required in order to reduce refining cost.

Consequently, palm fruits are sterilized in bunches and this softens the fruit from the spikelet. A bunch thresher is used to remove the individual fruits from the bunch. In the small scale mill, ‘dura’ fruits are mostly processed due to the type of planting material used on the farm. A processor explained that: *‘Consumers complain that palm oil produced from ‘tenera’ fruit are fatty, solidifies at low temperature, and does not give good taste. Therefore, ‘tenera’ fruit is mostly processed for end-users who use the palm oil for making soap’* (Aunty Esther, 16/03/2014, Kwae town). The activities carried out in the large and small scale mills points out that some processors have end-users in mind before they start producing palm oil. In the small scale processing mills, men are employed to split the FFB with the aid of a cutlass, an axe and wood. Although the small scale sector is described as women’s business (Tanle et al., 2011; Adjei-Nsiah et al., 2012a; Osei-Amponsah et al., 2012; Dauda et al., 2013; Osei-Amponsah, 2013), the role of men cannot be underestimated as men are found at various stages in the mills. This is confirmed in several interviews with small scale processors, for example a mill operator indicated that: *“The men own the mills, the technologies are operated by the men, and splitting is carried out by the men. This is because now, some stages of production require a lot of strength. Moreover, the volume of fruits to be processed have increased because the tanks have been designed to boil palm fruits in large quantities of over 5 tonnes of FFB”* (Atoo Kwamina, 11/03/2014, Kade town).

Men collecting loose palm fruits with shovel



Figure 4. 4 Men playing active roles in the processing of palm fruits

Source: Author's field survey, March 2014

The main purpose of splitting FFBs in the small scale mill is to aid in easy removal of palm fruits from the spikelet. This activity allows the tissue attached to the fruit and spikelet to sag with time. And it causes the fruit to detach from the bunch. Palm fruits may be stored for some days before women are hired to remove individual fruits from the spikelet. The cost of losing fruits from the spikelet is between GH 25 pesewas (\$ 0.09) to GH 50 pesewas (\$ 0.19) per buckets for each labour. Afterwards, the fruits are gathered and allowed to ferment for about 1 to 2 weeks. Some processors extend the period to 3 weeks or 1 month. A processor gave an explanation for this practice:

“The fermented fruits generate a lot of oil because when we store the fruits, the moisture in the oil evaporates when it is dried under the sun. The fermented fruits therefore have soft mesocarp which increases the amount of oil yield whereas fresh fruits generate a lot of sludge (‘bordor’). Therefore, we use fresh fruits for making ‘dzomi’. If the type of oil to be processed is ‘dzomi’ we keep the fruits for about 3-7 days, for ‘ngo paa’ it is kept for 7- 14 days and ‘samina ngo’ from 14 days to 21 days or even one month. It is impossible to carry out processing after three days of harvesting because it is not easy to remove the fruits from the spikelet with the hand” (Aunty Azumah, 16/03/2014, Kwae town).

The type of palm fruits available also determines the period for storing palm fruits. If it is ‘dura’, we store it for 5-7days and ‘tenera’ fruits are stored for 2-3 weeks. This is because ‘tenera’ fruits have thick mesocarp and so it generates a lot of sludge. Also, its thick mesocarp does not allow easy flow of oil when we use the hydraulic press” (Aunty Akua, 26/03/2014, Kusi town).

Yet, Tagoe *et al.* (2012) have stressed that this activity leads to increase FFA in the fruits which affects the quality of the palm oil. In fact, small scale processors produce mainly to meet local demand therefore, the rate of FFB in the oil is not a requirement to them. Thus, these activities are regarded as value addition strategies (USDA, 2002). Furthermore, Poku (2002) also indicated that the amount of FFA in the fruits adds flavor to the oil and they are considered as primary quality with a good laxative effect when consumed. In addition, Osei-Amponsah's (2003) study on this technology of oil production has proved that the method used by local processors yields high amount of oil in the study area.

After fruits are stored to the required time, women and men are engaged to collect the fruits into a metal drum locally called '*loco*' ranging in several sizes at cost between GH¢5 (\$ 1.91) to GH¢ 8 (\$ 3.06). The men use shovels to collect the fruits into pans carried by women and children. The tanks are then covered with sacks, torn clothing, and rubbers. Subsequently, fruits are boiled with firewood, lorry tyre and in most of the mills, the waste generated from the palm fruit which include pressed palm cake, empty fruit bunch (EFB), fibers, and sludge are used as fuel. Depending on the size of the tank, 1 to 2 barrels of water is used to boil the fruits.

The sterilization or boiling of the palm fruit is very important because it contributes to the success of other activities in the mill. Sterilization or boiling enables heat to : (1) destroy oil splitting enzymes, arrest hydrolysis and autoxidation which have impact on the quality of the oil; (2) weaken the fruit from the fresh fruit bunches; (3) solidify proteins in the oil; (4) weaken the pulp structure, soften it, and make it easier to detach the fibrous material and its contents during digestion process; and (5) causes contraction and expansion of the nuts which facilitates nut cracking (GOPDC mill, 18/03/2014, Kwae town). Sterilization in small scale mills last overnight and the fruits are boiled

again early in the morning before they are digested so that the heat will aid in easy flow of oil. Due to the quantity of palm fruits processed and the tedious nature of boiling the fruits, some men are contracted in some of the mills especially at Kusi and Asuom to boil the fruit for a fee of GH¢ 8 (\$ 3.06) a tank.

This process is followed by digesting the fruits which is, mashing boiled fruits to enhance easy pressing of oil. This is done by collecting the boiled fruit from metal tanks by women and men into a digester. The men fetch the fruit from the tank into a pan carried by women and then transfer it into a digester for mashing. The equipment used for adding value to the boiled fruit in the small scale mills includes digesters, the hydraulic press, and the combine digester-press. With the exception of the digester screw press which is designed to digest and press oil concurrently, other technologies require that mashed fruits are carried from the digester to the hydraulic press stand, by men or women. The digested fruits are pressed twice with the hydraulic press before the fiber is removed from the pressed cake. This activity is especially undertaken when the fruits are relatively fresh, for the purpose of making 'dzomi'. In GOPDC, the technology is that the boiled fruits are digested and pressed simultaneously.

After pressing, the oil is carried into a cooking pot by women in order to clarify the oil. This activity helps to reduce the moisture content in the oil. Traditionally, small scale processors produce two distinct varieties of traditional palm oil best distinguished by their local names 'Dzomi' (literally meaning heated oil) and 'Amidze' (meaning red oil). This latter variety is also called 'Ngo mon' (Fanti), 'Ngo paa' (Twi), and 'Mutsuru' (Ga). The quality of the oil is determined locally by: *"it taste, smell and colour. When the oil lingers on the tongue then, it is not a quality oil for cooking"* (Auntie Afua, 20/03/2014, Subi town). At this point, 'ngo paa' or 'samina ngo' is fetched into a barrel without clarifying the oil. The part that is clarified with heat is the sludge mixed with oil. In the

case of 'dzomi', the pressed oil comes out with a lot of sludge; hence, the oil is boiled until the moisture content is reduced. A salt solution is added to the oil to produce bubbles for a while before the fire is quenched. The purpose of this value adding activity is to produce a good aroma and taste which is desired by home consumers. The oil is collected into a pan and it is allowed to cool for 1 or 2 hours before it is packaged. 'Dzomi' has large markets in Ghana, because a processor explained that: "*They are assumed to be of good quality, have good taste and nice aroma when used for dishes*" (Aunty Esi, 15/03/2014, Subi Town). Some amount of water is added to the sludge and the mixture is boiled again for about 1 to 2 hours before the oil is collected and packaged for distribution. In GOPDC, the pressed oil is clarified in a clarifying tank and filtered of any sediment. The crude palm oil is transported to a refinery or loaded into a tanker for customers to add values to the oil. In the small scale mills, the palm oil is packed in 22.5 liter gallon locally called 'kuffour' or 'frytol' gallon, 62.5 litre called jerricans and 250 litres also called drums.

4.1.7 Value Addition to the Waste Generated in a Small Scale Mill

The waste generated in the oil palm mills includes: palm oil mill effluent (POME), empty fruit bunch (EFB), kernels, sludge, fiber, and stalks. In GOPDC, the pressed cake which consists of kernels and fiber are transported to another unit to recover kernels. In the small scale mills, palm cake is sorted by the hand into fibers and kernels by women especially aged once who are paid between GH 25 pesewa (\$ 0.09) to GH 50 pesewa (\$ 0.19) for a cage of pressed cake. The recovery of kernel from the cake is done in the palm oil mill which indicates that palm oil processors begin the production chain for kernel processors. The kernels are heaped by the road side ready to be transported to the kernel mill. The fiber, locally called 'strawgen' is heaped up or sometimes covered with

sacks and rubbers for its internal exothermic reaction to generate heat for 3 to 4 days. It is subsequently pressed to obtain second grade oil which is useful for making local soap. In addition, the sludge is pressed together with the fiber to generate oil which is in high demand in the export industry for making soap. Therefore, the various practices described in the small and large scale mills are meant to meet demands of end-users. If processors undertake these initiatives so that they satisfy the needs of consumers, then it means that they are engaged in value addition (Evans, 2012).

4.1.8 Palm Kernel Recovery and Kernel Processing

The waste generated in the oil palm industry is a valuable resource because every waste contains varying degrees of resources that can be accessed through the principle of reuse and recycling. However, the palm kernel, palm oil mill effluent, empty fruit bunch, palm kernel cake, and palm kernel shells are not resources unless it is envisaged as such. Bradley (2012, pg. 1) citing Zimmermann (1951) indicated that: “Resources are not; but they become”. Oil palm processors therefore see the waste as a “golden” resource to mine for high returns than to remain unemployed or underemployed. Processing of kernels into oil is undertaken by four actors as a result, the VC is interrupted in the small scale processing stream in Kwaebibirem District. The actors are palm oil processors, palm kernel processors; small scale kernel oil processors and GOPDC. The reason why the VC is broken in the small scale sector is because of new technologies, methods of processing, time and human resources constrains. In a focus group discussion, kernel processors explained that:

“Processing the kernels takes more time; it is tedious; and less lucrative than producing palm oil. The work is very tedious because it takes 2 weeks to process 1 tonne of kernel whereas palm oil processors can use two days to process 1 tonne of

palm fruit. Hence, due to the tedious nature of processing the kernel, most of the palm oil processors leave this activity for us” (FGD, 15/03/2014, Subi Town). To expatiate further, a palm oil processor also explained that: “During the peak season fruits are in abundance and this demands that we process the fruits on time. In addition, there is a high demand for palm oil than kernel oil in Ghana; hence, we concentrate on the production of palm oil” (Azumah, 16/03/2016, Kwae town).

The addition of value begins from the palm oil processing mills where labourers are hired to sort the kernels from the fiber. The kernels are heaped and sold to kernel processors in kias or pickups. A kias cost between GH¢ 600-¢ 700 (\$ 229.77 - \$ 268.06) and a pickup truck cost between GH¢100 - ¢130 (\$ 38.29 - \$ 49.78) in the district. The vehicles are standard units used for measuring the kernels irrespective of their sizes. The prices are mostly determined by the abundance of kernel, well sorted kernel, dry kernels and season of production. GOPDC also buys a tonne of kernel at GH ¢180 (\$ 68.93) from medium and small scale processors. Mostly, palm oil processors supply kernels to specific processors or alternatively, kernel processors move from mills to buy kernels. Once palm oil processors produce oil throughout the year, buyers are assured of constant supply of kernels. Thus, kernel processors are able to obtain kernels based on trust, the abundance of kernels, friendship, longevity of business relationship and timely payments to suppliers.

After prices are negotiated in the mills, kernels are transported to kernel mills which are few distances away from the palm oil mill or sometimes, the kernels are transported to different communities. In addition, there are instances where palm and kernel oil processors are located at the same mill. This action is indicative of the fact that values are gained through timely delivery, efficient flow of logistics, and low cost of transportation. The idea of undertaking a productive activity which has not been

performed before or an activity which hitherto was done by another producer downstream is in conformity with Amanor-Boadu's (2003) idea of value addition in agriculture. In the kernel mills, processors work by clustering in groups. In addition, the mills are located at refuse dumps, outskirts of the towns and water logged areas as it is in the case of palm oil mills.

The kernels are dried further on the bare ground to reduced drying time since low moisture in the kernel has been identified as a pre-condition for excellent cracking. A leader of kernel processors at Subi said: *"A well dried kernel results in whole cracked kernels which are completely detached from the shells"* (Aunty Talata, 16/03/2014, Kwae town). At GOPDC, clean nuts are conveyed to a nut silo for drying to a moisture content of about 14% before they are fed into a nut cracker. The fibers within the kernel are blown away in a small scale mill with a 'hofer'. In GOPDC, the fibers are removed by depericarping from the nuts and this is achieved through the use of a rotating drum fitted with baffles. The fiber-nut mixture is fed into the drum rotating at 15rpm. The baffles elevate the fibre-nut mixture and allow them to drop. As they fall, a current of air is passed through them which blow the fiber away.

In the small scale mill, cracking of the kernel is achieved with a combine nut cracker and shell separator. As the nut are cracked, the shell fall through a wire around a shell separator. At this point, it is not all the shell that is able to fall out and so the nuts come out as a mixture of kernel and shells. In GOPDC, the kernels are passed through a process of metal detection, and the kernels are cracked into small/medium size nut and large size nuts. Cracking is achieved by passing kernels through two rollers rotating in opposite directions. Their movement imposes pressure on the kernel and causes the shell to break, releasing the nut.

The separating of nuts from shells is achieved by pouring kernels and shells into a clay bath in the small scale mill. The clay bath operates on the principle of floatation. It is prepared to a viscous state to allow kernels to float while the shells sink to the bottom. The kernels are scooped with a basket, washed with clean water and then dried. There are two ways of achieving this in GOPDC. These methods are known as dry/pneumatic and wet separation. With the dry separation method, which is likened to winnowing in the local set up, fragments of low density light shells and long fibres are blown out of the separator. The second method, wet separation is achieved through the use of water in a hydrocyclone which replaces the clay bath. Through the activity of centrifugal force, fast-moving water current is created within the cylinder-like hydrocyclone. The shells are drawn towards the bottom of the hydrocyclone whilst the kernels remain afloat and washed into a chamber.

After the nuts are washed and dried in the small scale mill, the palm kernel or palm oil processors do not continue to process the nuts into oil. Instead, they end the chain of production by selling the nuts to other processors who use improved equipment to generate oil from the nut. The reasons given by all the processors in various interviews is summarised to include: lack of market for the kernel oil due to the low use of kernel oil for cooking; inaccessibility to equipment; and the health risk associated with the traditional technologies. They indicated that they gain a lot by selling the kernels at this stage because they have the opportunity to sell the shells to companies who buy a Kia truck between GH¢ 300 to GH¢ 330 (\$ 114.88 - \$ 126.37). In addition, they sell the shells to GOPDC at GH¢ 70 (\$ 26.80) per a tonne. Hence, nuts are packed in jute sacks at a cost of GH¢ 35 (\$ 13.40) or GH¢ 36 (\$ 13.78) to companies or small scale oil. A kernel processor revealed that: *“They are able to generate 34 to 35 bags of processed nuts from 1 Kia truck of kernels”* (FGD, 15/03/2014, Subi town).

Some small scale processors buy the kernels directly from the palm oil processors and hire labour to undertake all the steps mentioned earlier to the ultimate generation of kernel oil. When these small scale kernel oil processors were interviewed on why they do not obtain and crack the kernels, one processor in Kade explained that: *“It is a tedious process which requires that I employ additional hands to undertake these activities. Hence, I prefer that these women process the kernels into nut for a fee in their own mills”* (Oga Michael, 19/03/2014, Kade town). This situation generates competition for kernel in the oil palm industry in Kwabibirem District. This is because small, middle and large scale companies compete for palm nuts. In addition, palm oil processors use some of the kernels as fuel.

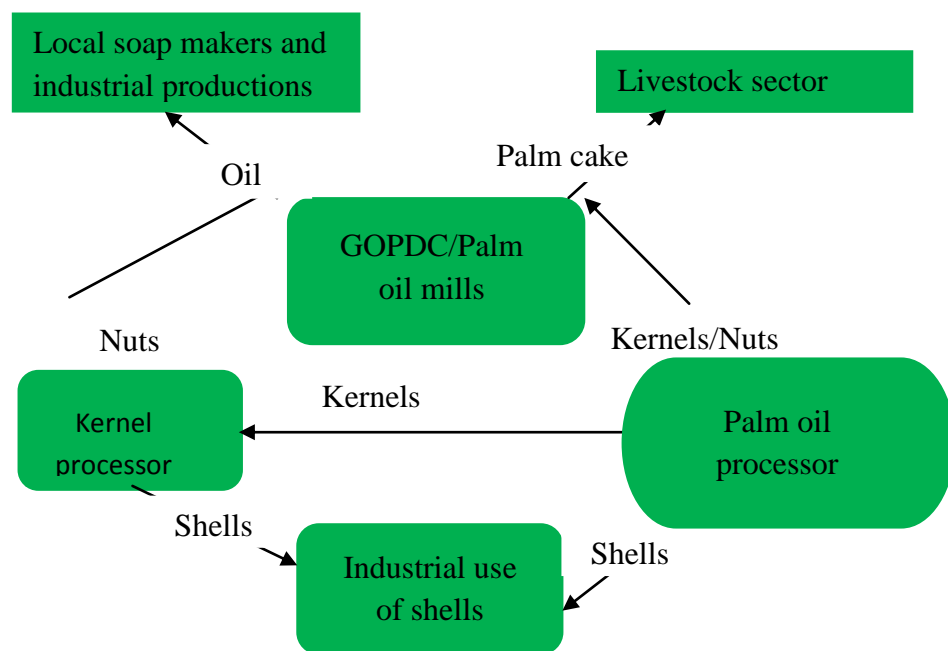


Figure 4. 5 The Flow of Palm Kernels from the Small Scale Palm Oil Mill to other users in the Kwabibirem District

Source: Author's construct based on field interviews, March 2014

4.1.8.1 Technological Changes in the Kernel Processing Industry

The sale of nuts to kernel oil processors begins another stage in the oil palm VC. The kernels are dried again by heating with a local technology which operates like an oven.

This activity mimics traditional roasting of nuts in a cooking pot and it helps in drying and hardening the kernels so as to facilitate easy grinding and generation of oil. The dried nuts are collected into a digester which is designed to grind and skim oil concurrently from the nut. The residues come out as flakes with no or little oil which is a good source of feed for livestock (see figure 4.6)



Roasting of palm nuts in a locally constructed oven



Oil flowing out of a digester screw press



Palm kernel flakes heaped down

Figure 4. 6 Processing of Palm Nuts into oil in a Small Scale Mill

Source: Author's field survey, March 2014

So the new equipment does not allow producers to go through traditional methods of roasting, grinding nuts, and boiling to release the oil. Also the residue is no longer in a form of palm cake which is usually soaked with oil. In GOPDC, the nuts are fed into a grinder which breaks them into small fragments. The fragments are then put through a roller mill which presses the kernels into flakes. The kernel flakes are put through a screw press directly after flaking and this is done accompanied with a great deal of heat. This is normally followed by a second press to achieve maximum extraction. The residue which comes out with the skimmed oil is stored in a tank to settle for about two days. The oil is collected and fine filtered to remove sediments before it finally stored for the purpose of loading into tankers and dispatched to customers. In the small scale oil mills, the oil is stored for a day and the residues from the oil are boiled to generate oil again.

The kernel flakes generated in the small scale and GOPDC mills are bagged in sacks and sold to poultry, cattle and pig farmers. GOPDC however, adds value to the flakes by rolling it into pellets for its customers. In the kernel oil mills, the main waste produce is palm kernel shells (PKS). It is sold to Electricity Company of Ghana (ECG), other electrical companies and to GOPDC.

4.1.9 Output Value Addition Marketing Strategies in the Oil Palm Industry

Traders use various strategies such as regional branding, direct marketing, quality products and product differentiations to market their products. All the processors interviewed indicated that they market their produce directly to traders at the mills. The reason given for this occurrence was:

“Even when we sell the oil directly in the urban markets, we are faced with a lot of structures. This include seeing the market queen, middlemen, and acquiring a shed. The cost of transportation is also high and the roads are not in good condition. So, it takes time before we can sell the oil or collect all our money. This makes it impossible for us to trade directly in the urban market” (Aunty Esther, 14-03-2014, Subi town).

Another marketing strategy adopted by processors is product differentiation or diversification of products. Some of the processors indicated in interviews that, they process ‘dzomi’ because it has large market and its selling price is always high than the other types of palm oil. Some processors also specialize in the production of ‘ngo paa’ or ‘samina ngo’ because this type of oil is in demand by traders who export the oil or sell to soap makers. In addition, regional marketing is another strategy adopted by processors to market their CPOs. The main communities noted for processing ‘dzomi’ are Asuom, Kwae, and Subi. In Kusi for instance, processors interviewed indicated that, the town is

noted for the production of only 'samina ngo' and these type of oil is also process at Kwae and Kade. In some of the communities like Kade, any variety of the palm oil is processed based on customers demand, season of production, and price of the oil. On market days, palm is also sold in drums, barrels, and gallons in the district capital, Kade. The trade in palm oil in the market is in the hands of auctioneers or whole sellers who sell to retailers, food vendors and consumers at the same time. In an interview with a trader, she specified that: "*In the community markets, palm oil is sold mostly in used voltic, fanta, beer and coca cola bottles to consumers and once the oil is sold in these bottles a little more than the usual amount is paid by buyers*"(Maa Jane, 16/03/2014, Kade town).

Small scale traders buy the oil in bits from many processors and finally sell to food vendors and other traders in big cities in Ghana. Some traders also export mostly, the second grade oil to Nigeria, Burkina Faso, Togo and Mali. Although processors trade directly from the mill which is a form of value addition strategy (Fairbairn and Gustafson 2004), it is mostly done through agents in different towns who buy the oil on behalf of the traders. In addition, there are cases where traders come to the mill to buy the oil themselves usually in the peak season. These agents may have sub agents in the towns and in each mill. Some of these agents pre finance the activities of the processors. However, a processor in an interview explains that this form of trade affect them because traders use this method competitively to control price and maximise profit. Togolese traders buy the oil at the mill on market days which falls on every Tuesday and Friday and other traders buy the oil on Thursdays and Wednesdays. This also depends on the market days for the destination of the palm oil. This is because some traders transport the oil to various towns in Togo on specific market days. Most of the Nigerian and Togolese

traders have assembly points in Kade Zongo where the oil is rearrange in huge trucks or cargos before their exported (Davi Ayawoo, 25/03/2014, Kade town).

However, there is low competition among processors because they produce almost the same variety and quality of oil. A processor had this to say about the situation: *“there is so much ease of entry into the industry because traders usually give money to labours on contract to produce oil for them. As a result, there are a lot of palm and kernel oil processors”* (Aunty Esther, 15/03/2014, Subi town). This activity leads to price distortions when processors have little income to carry out their activity. All the interviewees stated that traders propose the price of oil in the peak season whiles they also dictate prices during the lean season. Although processors are able to dictate prices in the lean season, they have low opportunities to choose among buyers in the peak season because buyers may get lower prices from other processors. They also indicated that processors cross check prices of CPO and kernels from other mills before selling to traders. Negotiations on the price of palm oil are also done over phone before an agent or traders come to the mill to buy the oil. A trader mentioned that they consider factors such as taxes and border issues; risk in terms of accident; loss of money; breakdown of vehicles; and price variations in urban centers before they bargain the price of CPO and CPKO. The prices of kernels, sludge and other items are also determined by the buying companies or individual buyers. It can easily be inferred that buyers are always dictating prices to suppliers in the oil palm industry. The exception is in the case of GOPDC which sell its products according to world market prices. Even so, it dictates the prices of FFBs, shells and kernels to its suppliers.

4.2.0 Midstream Production

Midstream production involves processing crude palm/kernel oil by refining, fractionating and distilling into marketable forms which are suitable for manufacturing food and non-food products. In Kwaebibirem District, midstream production is undertaken only by GOPDC and the refined products are: refined bleached deodorized oil, refined palm kernel oil, palm fatty acid distillate, vitamin A fortified olein, supet olein and stearin. These products are generated by refining, fractionating, deodorizing, distillation, crystallising and bleaching CPO and CPKO. There are two approaches by which value is added to the CPO and CPKO: Under physical refinery, oils are degummed using acids, bleached, and deodorized. This results in refined, bleached and deodorized palm and kernel oil as well as fatty acid. The second approach is a chemical process which involves the treatment of crude oil using alkaline sodium hydroxide on bleached and deodorized palm oil and palm kernel oil and fats (Quality Assurance, 18/03/2014, GOPDC-Kwae town). Refinery leads to the removal of colour and odour from the oil. The oil is fractionated into liquid state oil called olein and solid phase called stearin by thermo-mechanical means that is controlled by cooling, crystallization, and filtering. This value addition activity enhances vertical integration of processors activities into manufacturing through the supply of the oil to end-users. In this way, suppliers will be able to earn more because end users pay an additional price on this activity which has already been undertaken by midstream processors thereby shortening the distance in the VC (Webber & Labaste, 2010).

4. 3.0 Downstream Processing

Downstream production involves manufacturing and marketing of food and non-food products from refined and crude palm and kernel oil. Downstream end users are

industrial and local producers of food and non-food products from parts of the oil palm, CPO, and CPKO and the mill waste.

4.3.1 Industrial End-users

The manufacturing companies that take supplies of refined products from GOPDC are Lever Brothers Ghana Limited, Nestle Ghana limited, Palace Biscuit Limited, Piccadilly Biscuit Company, Indomie Noodle Company Limited, among others. At this stage, values added to the stearin and olein varies due to differences in research activities, availability of technology and consumer's demand. Olein is used for making cooking oil and with the aid of hydrogenation, inter-estification and blending of oils, stearin is manufactured into margarine, vanaspati, shortenings, soaps, and chocolate. In Ghana, the sludge is used for various local dishes; hence value is added to the sludge by canning them in containers by Nkulenu food industries and Despite Food Industries. Also, a Sludge Fertilizer Company at Kusi is able to produce fertilizer, palm oil and methane gas from the sludge produced in the small scale mills. There are some manufacturing companies that specialises in the use of some parts of the oil palm, palm/kernel oil and mill waste in its production. These are categorized as:

4.3.1.1 Oleo Chemical Industry

The oleo chemical related industry uses simple oleo chemicals derivatives for manufacturing detergents, cosmetics, personal care products, toiletries, varnishes, paints, coatings, alpha sulfonated methyl esters, polyols, polyurethane, and adhesives (MPOB, 2009). Other higher value oleo derivatives are processed into agrochemicals, surfactants, bio lubricants, bio polyols, glycerol derivatives, nutraceuticals, pharmaceuticals and bio-degradable plastics.

4.3.1.2 Biomass Industry

Palm fronds and EFBs have cellulose for making paper, textiles and pharmaceutical products (Hamid, 2008). The kernel shells are used for manufacturing pozzolanoa substitute for cement for construction purposes (Abdullah & Sulaiman, 2013). Fermentable sugars are derived from the EFB because it has lignocellulose and polysaccharides (Mior et al., 2012). The EFB, shells and fiber provide lignocelluloses material which has wide applications in furniture, automotive, and for stuffing car seats and mattresses (Abdullah & Sulaiman, 2013). The MPOB in (2009) indicated that high porosity carbon powder, carbon glassy, electrical carbon brushes are adsorbents and conductors which are derived from the EFB.

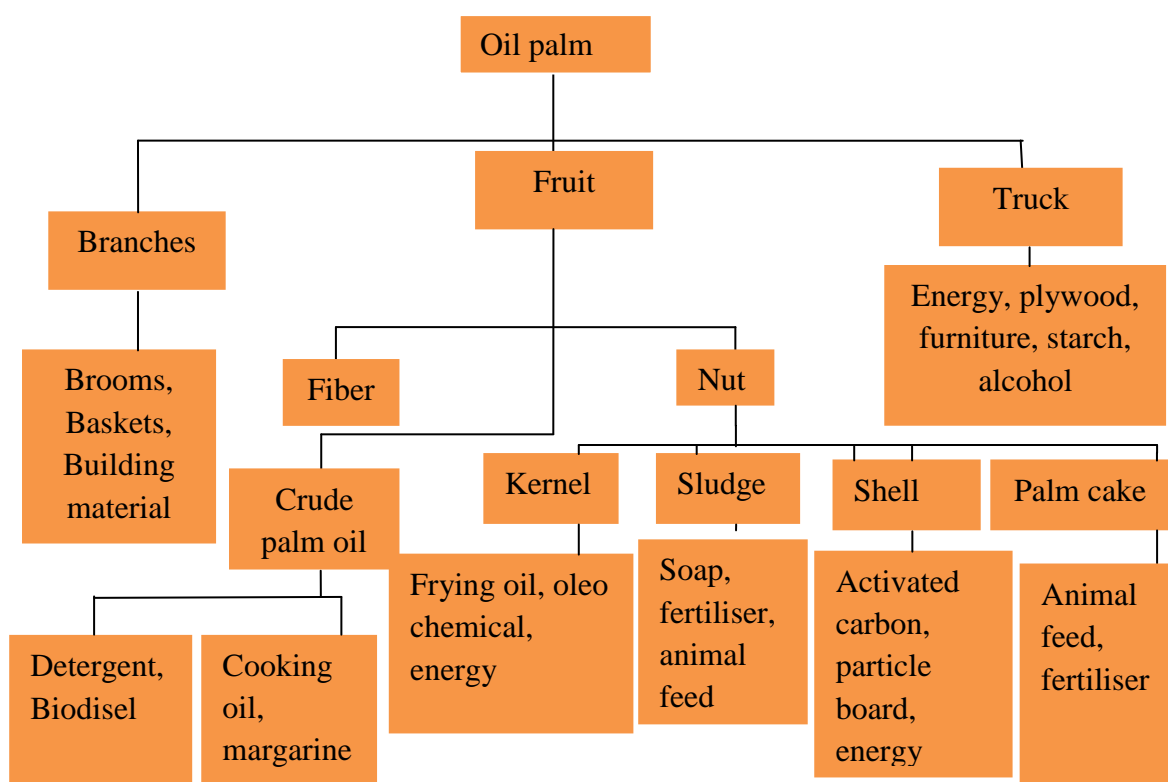


Figure 4. 7 End-use Product Value Chain of the Oil Palm

Source: Adapted from Fairhurst & Mutert (1999)

4.3.1.3 Bio-diesel and Renewable Energy Production

The palm and kernel oil are renewable energy sources. Therefore, electricity is generated from steam generated as a result of burning shells, EFBs, and fibers. Also, bio-gas is generated from methane gas in POME for the generation of electricity (Quality control unit, 18/03/2014, GOPDC Mill, Kwae town). These activities reduce the amount of effluents released into the natural environment.

4.3.2 Local End-users of the Palm and Kernel Oil

The main users of CPO are households, local food vendors, restaurants and institutions. The kernel oil is mostly purchased by soap makers who processed it into low quality soaps. In rural areas, the kernel is transformed into pomade by applying the oil mixed with other herbs on the skin. It also serves as therapeutic all-purpose oil which can be used as liniment to reduce body pains. The kernel oil is also mixed with imported scents such as lavender and Florida Waters and it is used by women as hair oil pomade. A homemade furniture polish is generated by mixing kernel oil with kerosene.

The values added to the parts of the oil palm include the production of baskets and brooms from the branches and veins of palm leaves respectively. Palm fronds are used for constructing thatched roofs, fences and fodders for feeding goats. The dried shells are used by blacksmiths, bakers and charcoal burners. Socio-cultural values are attached to the sap of the crop called palm wine, also a rich source of yeast and sugar. A vegetable 'cabbage' is derived from the soft tissue around the apical bud in the trunk. The palm wine can be distilled into a local gin called '*akpeteshie*'. The inner tissue of the palm trunk is good for treating gonorrhoea, abdominal pains, and as a laxative. The trunk is also a good source of edible mushrooms. The EFBs and shells are used in rural areas for filling pot-holes, constructing roads, preventing erosion and used as fuel.

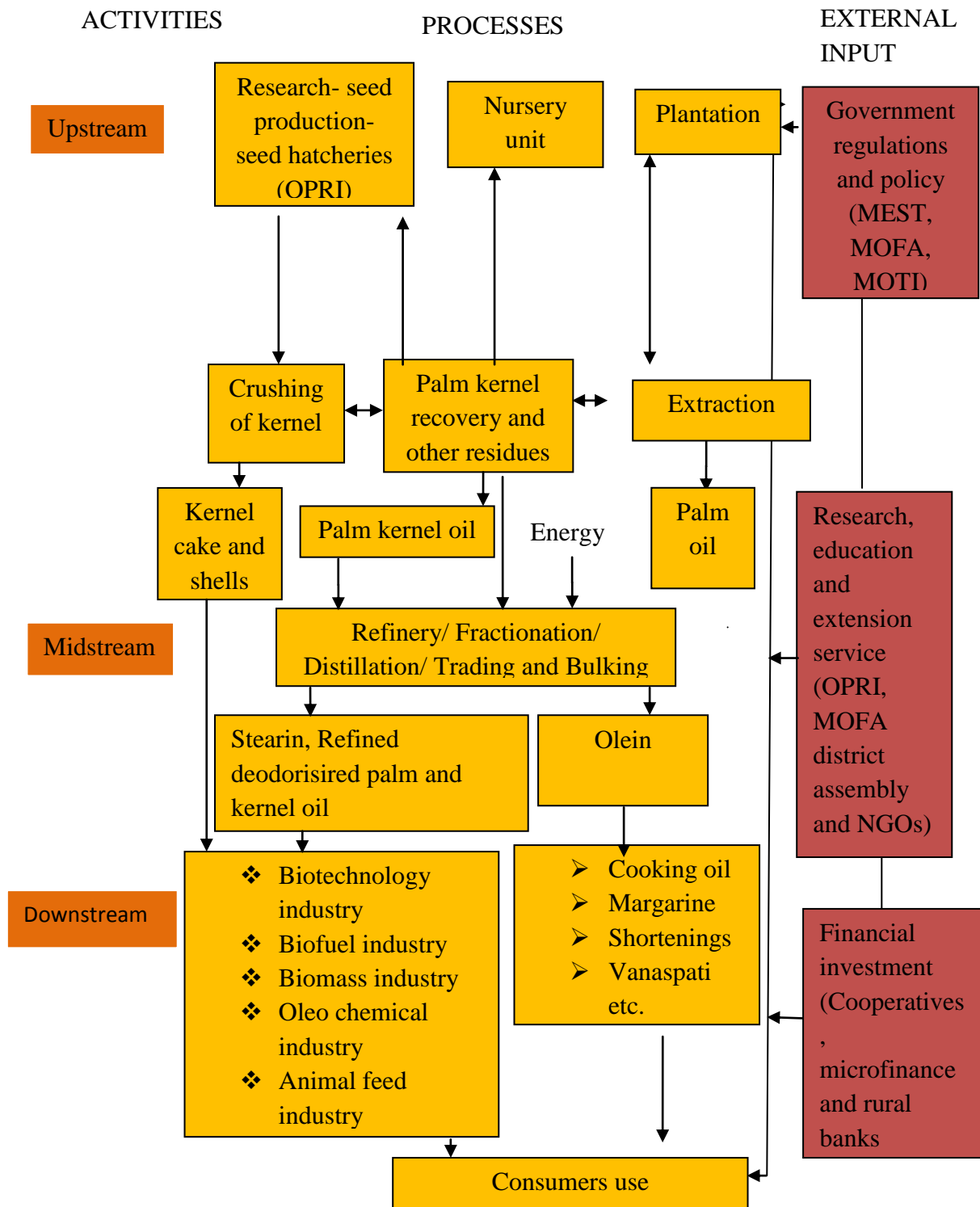
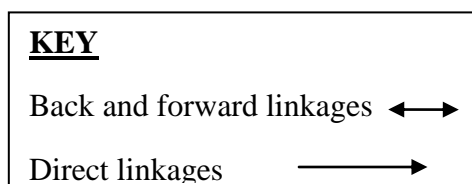


Figure 4. 8 Value Web in the Oil Palm Industry

Source: Author’s conceptualisation based on various account on the oil palm industry, March 2014



4.4 Conclusion

This chapter focused on the character of activities that generate value along the chain of production and service delivery in the oil palm industry. The study demonstrated that value addition in the oil palm VC in Kwaebibirim District is a well-built vertical integration in the large scale sector (see figure 4.8). However, reuse of waste and poor coordination in the production chain have contributed to a formation of a value web in the oil palm industry other than the vertical chain demonstrated in the value chain theory. The small scale processors in the oil palm VC uses various innovative means to add value to FFBS. The study established that only GOPDC carries out refinery of palm and kernel oil in the district. Downstream activities are undertaken locally in various forms; however, industrial productions are carried out in urban areas.

CHAPTER FIVE

CONTRIBUTION OF VALUE ADDITION TO SOCIO-ECONOMIC DEVELOPMENT

5.0 Introduction

This chapter discusses how the process of value addition contributes to socio-economic development, especially employment, income, and its implication for socio-economic development in the Kwaebibirem District. As indicated in chapter 3 (3.6.6), the analysis is based on a questionnaire survey carried out with two groups of small scale oil palm processors and interviews from other actors in the oil palm industry. The chapter first examines income generated by palm fruit and kernel processors. In addition, the chapter analyses the number of people employed by processors, benefits and the contributions of value addition activities to the growth of other industries. Finally, the implications of the analysis of the net income and employment for socio-economic development are discussed.

5.1 Personal Characteristics of Respondents

Results of the sex distribution of processors on table 5.1 shows that 67.5% women and 32.5% men were processing palm fruits. While 93.3% women and 6.7% men were processing palm kernel. This shows that women dominate in the processing of palm fruits and kernels. This finding supports claims made by Carrere (2013); Danyo (2013); Osei-Amponsah (2013); Ofose-Budu and Sarpong (2013) that palm fruit processing is a woman's industry in Ghana. Although the production of palm and kernel oil is stressed to be women's business, 39.2% of the respondents were men. It shows that men are increasingly finding a niche in the processing of the palm and kernel oil. This is because the percentage of men who were processing palm fruits have increased compared to 11%

of men indicated by Adjei-Nsaiah *et al.* (2012a) who carried a study on the oil palm in Kwaebibirem District. The rise in the number of men processing palm fruits especially can be attributed to the profitable nature of this activity. Further probing of this issue revealed that processing palm fruits is a kitchen business reserved for women. However, in reality a man can also cook, split, and press the oil. Hence, since the unemployment rate in rural areas is increasing, men have taken advantage of the boom in small scale processing of the palm fruit to operate in the industry than to migrate to urban areas where jobs are not readily available. As such, the increasing number of men who were processing palm fruit can be explained as an issue of changes in gender roles in response to changing economic situations.

Type of processors	Sex	Frequency	Percent
Palm fruit	Male	26	32.5
	Female	54	67.5
Total		80	100
Palm kernel	Male	2	6.7
	Female	28	93.3
Total		30	100

Table 5.2 Age of processors in percentages

Source: Author's field survey, March 2014

Majority (62.5%) of palm fruit processors were between 30–40 years, 30% were between 15-30 years, 6.3% were between 40-50 years and 1.3% was between 50- 60 years (Table 5.2). The age distribution of kernel processors also shows that majority (43.3%) were between 30-40 years of age, followed by 20% for 15-30 years, 16.7% for 40-50 years, 13.3% for 50-60 years and 6.7% for 60 years and above. From table 5.2, majority of the

two groups of processors were between 30-40 years which is an indication that processors were in their active age. This also suggest that processors were matured enough to bring their experiences to bear on processing of palm fruits and kernel; accordingly, making way for efficiency and innovation in the oil palm industry. In addition, the low number of processors who were between 40–60 years may be as a result of the tedious nature of processing palm fruits.

Processors	Age of respondents	Frequency	Percent
Palm fruit	15-30	24	30.0
	30-40	50	62.5
	40-50	5	6.3
	50-60	1	1.3
	60+years	0	0
Total		80	100
Palm kernel	15-30 years	6	20.0
	30-40 years	13	43.3
	40-50 years	5	16.7
	50-60 years	4	13.3
	60+ years	2	6.7
Total		30	100

Table 5. 1 Age of processors in percentages

Source: Author's field survey, March 2014

Table 5.3 shows the percentage distribution of the marital status of palm fruit processors. A substantial majority, 65% were married, 25% were single and 10% were widowed. Majorities (57.5%) of palm kernel processors were married, 27.5% were single and 15% were widowed. The fact that majority of processors were married, shows that they may have the responsibility of meeting household needs. Household, as defined in this study, refers to a group of people living in one house collectively as a family along with relatives such as in laws, cousins, and nephews and so on and nonrelatives such as servants.

Processors	Marital status	Frequency	Percent
Palm fruit	Married	52	65.0
	Single	20	25.0
	Widowed	8	10.0
Total		80	100
Palm kernel	Married	17	56.7
	Single	9	30.0
	Widowed	4	13.3
Total		30	100

Table 5. 2 Marital status of palm fruit and kernel processors

Source: Author's field survey, March 2014

Table 5.4 shows that palm fruit processors, represented by 57.5% have household sizes between 5-10, 33.7% for household size between 1-5 people and 8.8% for household sizes above 10 people. The results of palm kernel processors also shows that 46.7% of processors have household sizes between 5-10, 33.3% for 1-5 household size and 20% for above 10 household size. Since each respondent indicated that they have dependents

to cater for, then it stresses a fact that, all the processors may use proceeds to cater for household needs.

Processors	Household size	Frequency	Percent
Palm fruit	1-5	27	33.8
	5-10	46	57.5
	10+	7	8.8
Total		80	100
Palm kernel	1-5	10	33.3
	5-10	14	46.7
	10+	6	20.0
Total		30	100

Table 5. 3 Household sizes of palm fruit and kernel processors

Source: Author's field survey, March 2014

Majority (81.3%) of palm fruit processors have had formal education (Table 5.5). This is expressed as 41.3% for junior high school education, 17.5% were educated up to the primary school level, 17.5% senior high education, 5% had tertiary education and 18.8% had informal education. Table 5.5 also shows that (33.3%) of kernel processors were educated up to the primary level, 26.7% junior high school level, 13.3% senior high school level, 26.7% had informal education and none had tertiary education. The differences in the level of education between the two processors show the prestige attached to each of the activities. In probing further by interview to find out about the differences in the level of education among processors, it was disclosed that kernel processing is mostly undertaken by migrants who do not have access to palm fruits and land to cultivate crops. Consequently, kernel processing is also perceived as a menial job for the uneducated or the unemployed. Hence, educated people were likely to associate

with more prestigious activity. Processing of palm fruits and kernels does not strictly require formal education because skills are learnt or passed on from older and experienced processors. However, an encouraging finding in this study is that, majority of processors had formal education. Therefore, it is likely that formal education may help processors to understand issues better, anticipate and respond to market needs. Education is found to enhance processors ability to manage risk, uncertainty, and capital mobilization skills (Ajani *et al.*, 2012). Formal education is likely to cause processors to appreciate the need to use quality palm fruits and nuts, quantities to process, and calculate loss and benefits in their businesses.

Processors	Level of education	Frequency	Percent
Palm fruit	Primary school	14	17.5
	Junior high school	33	41.3
	Senior high school	14	17.5
	Tertiary	4	5.0
	Non formal	15	18.8
Total		30	100
Palm kernel	Primary school	10	33.3
	Junior high school	8	26.7
	Senior high school	4	13.3
	Tertiary	0	0
	Non formal	8	26.7
Total		30	100

Table 5. 4 The level of education of processors

Source: Author's field survey, March 2014

The number of years processors have been engaged in either activity can affect the amount of income, efficiency of production and the adoption of value addition strategies. On figure 5.1, 32.5 % of respondents have been processing palm fruits between 5-10 years, 40% have been processing between 11-20 years and 16.3% for 20 years and above. Majority (30%) of kernel processors have been in the business between 5-10 years, 26.7% for less than 5 years, 20% between 11-15 years, 16.7% between 16-20 years and 6.7% have been processing kernels for over 20 years. From table 5.6, majority (32.5%) of palm fruit and kernel processors (30%) have been in business between 5-10 years. This indicates that most processors have been in the business for a long time. Through interviews it was realized that processors have not received any formal training on processing of palm fruits and kernels. Hence, the average years of experience (5-10 years) shows processors might have spent some time under-studying their mentors.

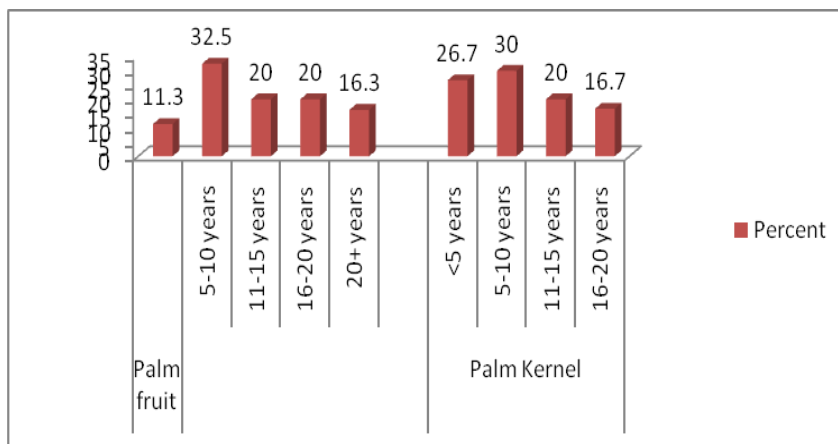


Figure 5. 1 Duration for participating in palm fruit and kernel processing activities
Source: Author's field survey, March 2014

5.2 Socio-economic Characteristics of Respondents

Palm fruits and kernel processors were engaged in a series of activities in the small scale sector. Figure 5.2 shows that 13.8% of palm fruit processors were engaged in oil palm farming, palm fruit and kernel processing; 43.8% were into oil palm farming and palm

fruits processing; 23.8% were processing only palm fruits; 7.5% were processing palm fruits and kernel; 3.8% were engaged in processing fruits and trading palm oil; and 7.5% were engaged in processing palm fruits and soap making. With kernel processors, 70% process only palm kernels, 20% process palm fruits and kernels, and 10% were producing oil palm and processing palm kernels. From figure 5.2, it can be realized that processors have taken the initiative to engage in series of activities which have led to the formation of a vertical chain. This, according to Coltrain *et al.* (2000) is a value addition strategy and a structural element of agricultural value chain (Boehlje *et al.*, 1999). Furthermore, these activities in the production chain could have been performed by other groups downstream but processors have taken hold of these opportunities so that they can generate more income. Subsequently there is the need to find out the size of farm land own by processors and how proceeds are utilized.

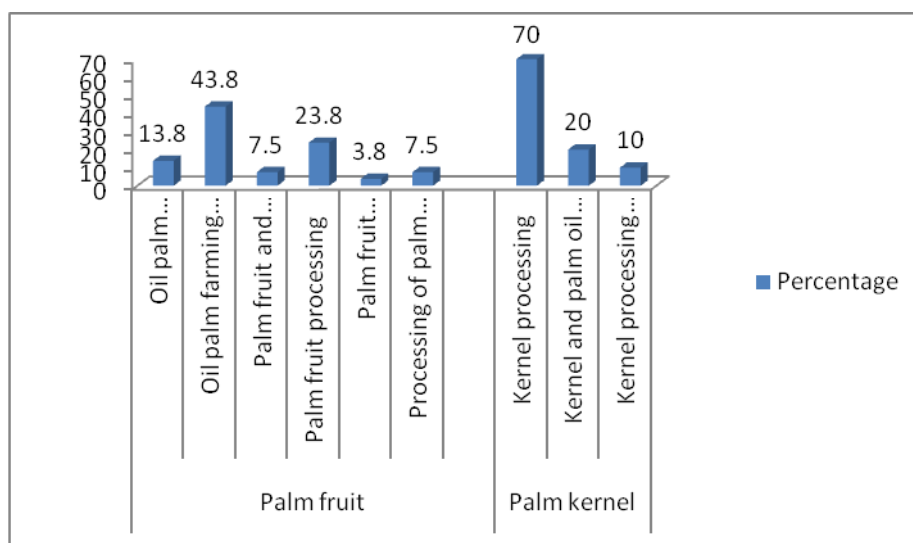


Figure 5. 2 Distribution of vertical productive activities engaged by processors

Source: Author's field survey, March 2014

The result on figure 5.3 shows a summation of the number of palm fruit processors who own oil palm farms to be 65%. This implies that 35% were only processing palm fruits and were not into oil palm farming. It may be that processors were using palm fruits

from family farms; care takers of family farms; or perhaps, inherited oil palm farms. The number of men operating in the sector may also account for the high number of processors who were processing palm fruit. With regards to the distribution of harvested fruits from the farm, figure 5.4 shows that 36.3% of farmer-processors process their fruits directly, 27.5% process and sell some of the harvested fruits and 1.3% sold entire proceeds. The low percentage (1.3%) of farmer-processors who sell their fruits is a sign that processors were willing to process fruits from their farms.

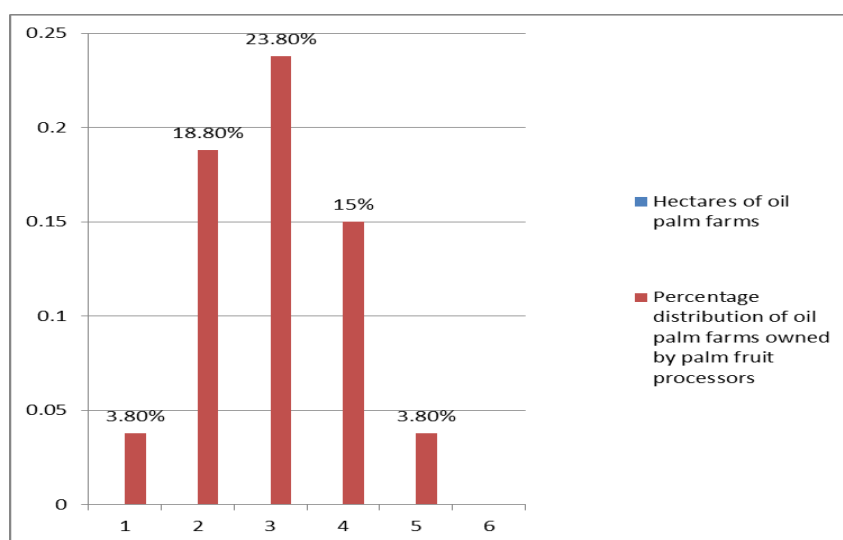


Figure 5. 3 Sizes of oil palm farms owned by farmer-processors in hectares
Source: Authors field survey, March 2014

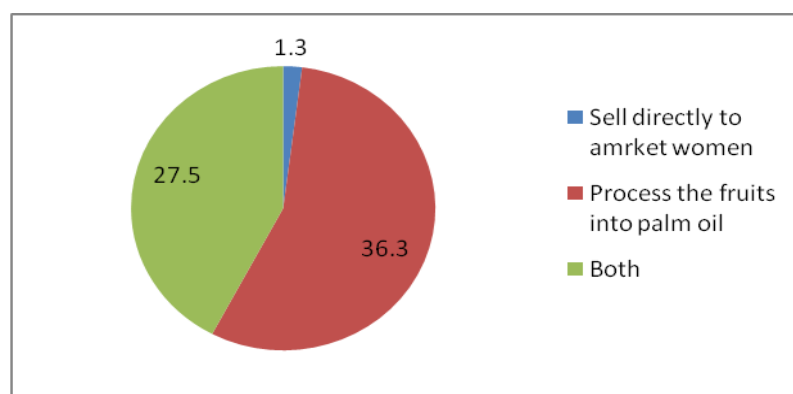


Figure 5. 4 Percentage distribution of palm fruits from the farm by farmer-processors
Source: Author's field survey, March 2014

5.3 Income generated through Processing as a Value Addition Strategy

Several approaches have been employed to characterize value addition systems in agriculture. But for the purpose of the objective of this chapter, processing is the only value addition strategy measured. This is because the processing of palm fruits and kernels are entirely a process of value addition due to the fact that palm fruits and kernels are transformed at every stage until oil is generated. Hence, to determine the amount of income generated through processing, the net profit approach was used to calculate the returns generated through this initiative. The 110 respondents specified that they were engaged in value addition which accounts for 100% participation of processors in value addition although it was carried out in diverse ways. This means that all the respondents add some utility to the palm fruits and kernels. The average cost of processing 1 tonne of fresh palm fruit and kernel is shown on table 5.6 and 5.7 respectively.

The total average cost of processing 1 tonne of FFB was GH¢ 379.25 (\$ 145.23) and the total average variable cost was GH¢ 309.13 (\$ 118.38). Subsequently, the gross profit calculated was GH¢387.67 (\$ 148.45) while the net profit was GH¢ 375.72 (\$ 143.88). It is therefore obvious that the value added to a tonne of FFB through processing has the capacity to generate profit for processors. The Benefit-cost ratio ($BCR=TR/TC$) on table 5.6 was 2.17. Since the ratio calculated was above 1, the net profit was considered positive. Therefore, processing of palm fruits as a value addition strategy is a profitable strategy.

Item	Amount (Ghana Cedis)
Returns	
Palm oil (Average quantity of oil processed × Average price of oil)	503.42
Palm kernel	148.63
Fermented oil	42.55
Sludge	2.20
Total gross return	696.38
Variable Cost	
Fresh fruits bunches (FFB)	238.13
Transport	31.09
Splitting of FFB	7.20
Removal and cleaning of fruits	3.65
Loading of fruits into boilers	4.71
Cooking	4.55
Unloading of fruits from boilers	4.01
Others (Water, firewood etc.)	4.56
Digesting and pressing	8.45
Clarification	2.78
Total variable cost	309.13
Fixed Cost	
Rent	7.39
Others(Interest on borrowed Capital, maintenance & repair)	5.56
Total fixed cost	11.95
Total Cost (TVC+TFC)	321.08
Gross Profit (Total gross return-Total Variable Cost)	387.67
Net profit (Total Gross Return- Total Cost)	375.72
Benefit-Cost Ratio (BCR=TR/TC)	2.17

Table 5. 5 Average Income generated from processing 1 tonne of palm fruit

Source: Author's field survey, March 2014

With regards to palm kernel processing, the result indicates that the total average cost of processing a tonne of palm kernel was GH¢180.77 (\$ 69.22) (Table 5.7). Processing of kernel to obtain palm nuts packed in jute sacks in Kwaebibirem District is a profitable business venture. This is evident by a gross profit of GH¢126.26 (\$ 48.35) and a net profit of GH¢ 112.86 (\$ 43.21) per a tonne of processed palm kernels. Using Benefit-cost Ratio to test for the profitability of this activity, results on table 5.7 shows a ratio of 1.73. This confirms that adding value to the kernel by processing to generate palm nuts was a viable business activity because the benefit-cost ratio exceeded 1.

Item	Amount (Ghana cedis)
Returns	
Palm nuts (Average palm nuts processed × Average price of a sack of palm nut)	248.01
Kernel	62.67
Fiber	1.73
Total gross return	312.41
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Variable Cost	
Palm kernels	114.33
Transport	18.57
Funning off fiber	9.87
Cracking of kernels	10.40
Clay washing	11.87
Other (Fetching water, clay and sacks)	2.33
Total variable cost	167.37
<hr/>	
Fixed Cost	
Rent	8.45
Others (Interest on borrowed Capital, maintenance & repair)	4.97
Total fixed cost	13.4
Total Cost (TVC+TFC)	180.77
Gross Profit (Total Gross Return-Total Variable Cost)	145.04
Net profit (Total Gross Return- Total Cost)	131.64
Benefit Cost Ratio (TR/TC)	1.73

Table 5. 6 Average income generated from processing 1 tonne of palm kernel

Source: Author's field survey, March 2014

Table 5.8 shows an average cost of processing 1 tonne of fresh fruit bunch (FFB) to be GH¢ 238.13 (\$ 91.19). After processing 1 tonne of palm fruits, an average amount of 11.14gallons (250.65 liters) of palm oil was generated. Eight tones of FFB are processed to obtain 1 tonne of crude palm oil. This implies that the net income calculated for 1 tonne of FFB and kernel is not equivalent to 1 tonne of crude palm oil and palm nut. Since it was difficult to determine the equivalent of 1 tonne of FFB to the amount of crude palm oil generated by small scale processors, the average quantity of gallons (250.65 liters) was used as the standard unit for 1 tonne of crude palm oil produced from a tonne of fresh palm fruit in the Kwaebibirem District.

As shown on table 5.8 the average selling price of palm oil in the lean season was GH¢ 69.03 (\$ 26.43) per 22.5 liters (*'Kufour gallon'*) and in the peak season, the average selling price of palm oil was GH ¢45.19 (\$ 17.30). This illustrates that the returns on adding value to the palm fruit through processing during the lean season was more profitable. In probing further on the prices of the varieties of palm oil, it was revealed that the price of *'dzomi'* is always GH ¢10 (\$ 3.82) per 22.5 liters higher than the *'ngo paa'* and *'samina ngo'*. Thus, in the peak season when prices are relatively low, palm fruit processors produce more of *'dzomi'* oil in order to make higher returns.

Average quantity of palm oil produced	Average price of palm oil in the peak season	Average price of palm oil in the lean season
11.14 gallons (equivalent to 250.65 litres or 1 barrel)	¢45.19	¢69.03
Selling price of 1 barrel of palm oil for each season	¢503.42 = (¢ 45.19 × 11.14 litre)	¢768.99 = (11.14 litre × ¢ 69.03)

Table 5. 7 Seasonal income generated from selling palm oil

Source: Authors field survey, March 2014

Table 5.9 explains the value generated on each activity involved in processing palm fruits. It can be deduced that it is more advantageous to process the FFB before selling. The value of palm fruits increases according to the season of production and the type of oil produced.

Activities	Cost of operation	Output	Selling price of output	Value of activity
Palm fruit processing	¢306.35	Palm oil	¢503.42	¢ 197.07
Clarification of oil	¢1.50	Sludge	¢2.20	¢ 0.70p
Pressing second grade oil	¢ 2.18	Palm oil and fiber	¢42.55	¢ 40.37
Sorting kernel	¢ 4.76	Palm kernel	¢148.63	¢ 141.87

Table 5. 8 Average cost of operation and average sales output of various value addition activities for processing 1 tonne of palm fruit
Source: Author's field survey, March 2014

On table 5.10, the average income derived from processing palm kernels to obtain the nuts in the lean season was GH¢ 1,736.07 (\$ 664.82) at an average price of GH¢ 35.43 (\$13.56) by an average quantity of 49 jute sacks. In the peak season (February-May), processors generate GH¢ 2,976.12 (\$ 1,139.70) at an average price of GH¢ 35.43 (\$ 13.56) by an average quantity of 89 jute sacks. With kernel processing, there were no changes in the prices of processed nuts with regards to seasons. This may account for the low number of people participating in this venture in the district. In addition, benefit cost ratio of 2.17 for palm fruit processors against 1.62 calculated for kernel processors shows that the returns from palm fruit processing is higher than kernel processing. This occurrence is largely attributed to the fact that palm kernel processors do not process the nuts to generate oil but rather, they sell the nuts to other small scale processors.

Average quantity produce	Average price of a sack of palm nuts	Quantity generated monthly in the lean season	Quantity generated monthly in the peak season
7 sacks (1 tonne)	¢35.43	7 tonne (49 sacks)	12 tonnes (84 sacks)
Income for each quantity	1 tonne (7 jute sack \times 35.43) = ¢248.01	7 tonne (¢35.43 \times 49sacks) = ¢1,736.07	(¢35.43 \times 89 sacks) = ¢2,976.12

Table 5. 9 Quantity of income generated from the sales of the palm nuts
Source: Author's field survey, March 2014

The cost and benefit of the various value addition activities in processing kernel is summarised on table 5. 10.

Activity	Cost	Output	Selling pricing	Value of activity
Processing kernel	¢ 153.17	Palm nuts	¢251.47	¢ 96.57
Sales of kernel shells	¢ 14.2	Shells	¢62.67	¢ 48.47

Table 5. 10 Average cost of operation and average sales output of various value addition activities for processing 1 tonne of palm kernel
Source: Author's field survey, March 2014

The total income for processing 7 jute sacks (1000 kg) of kernel by an average price of GH¢ 35.43 (\$ 13.56) was GH¢ 248.01 (\$ 94.97) (Table 5.10). In addition, palm fruits processors were likely to make more money due to the fact that they generate more by-products such as sludge, fermented oil and palm kernels which were equally marketable products. Whiles kernel processors derive only kernels shells and fibers as by-products.

A key characteristic of value addition in agriculture posited by Knop and Tronstad (2000); and Evans (2012) is that, farmers take hold of every opportunity in the production chain. It can be realised that processors who take charge of the entire production chain by producing oil palm, processing the palm fruits as well as processing the kernels were likely to generate more income than those who carried a single value addition activities in the small scale processing chain.

Similarly, processors who were processing palm fruits and kernels were likely to generate more income. Result also shows that it is more profitable for a farmer to add value to the palm fruit by processing the FFBs than to sell it at the farm-gate. This confirms the first hypothesis of the study that value addition to the oil palm increases income. The economic importance of adding value to palm fruit and kernel is underscored by the report of 82% of processors who indicated that 50% or more of their income was derived from value addition venture. Only 18% processors reported that they derive 50% or more of their income from other sources such as remittances and other business activities apart from those carried out in palm oil mill. Processors were of the view that the benefits, particularly in terms of income and employment generation are the most significant advantages derived from the industry.

5.4 Employment

This section discusses the implication of value addition through processing of palm fruits and kernels for employment generation. The main source of labour for processing palm fruits and kernel is hired labour. Although some household members are sometimes engaged in activities in the mill, results indicates that palm fruits processors employ average number of 10 and 8 people to help process 1 tonne of palm fruits and kernel respectively. Interviews revealed that the quantity of FFB or kernels to be processed and

the type of palm oil to be processed determines the number of people to be employed. Subsequently, information from interviews was used to find out about the number of people employed at each stage of the production chain. It was revealed that processing of palm fruits and kernels has the ability to create employment for about 10-34 people and 8-18 people by a palm fruit and kernel processor respectively in the study area. Employment is also generated for labourers, caretakers, sub-agents, agents and traders.

5.4.1 Test of Relationship between Income and Employment

The research work sought to investigate whether or not there is any significant relationship between income (value added) and the level of employment in the palm oil industry. The correlation analysis performed thereof reveals that there was a weak positive relationship between income and employment. In other words, the more people are employed in the industry, the more income is generated and vice versa. However, this positive relationship is not statistically significant at ($p > 0.05$). It could subsequently be concluded that there is no relationship between (income) and employment levels (Table 5.11).

		Correlations	
		value-added	Employment
value-added	Pearson Correlation	1	.081
	Sig. (2-tailed)		.476
	N	80	80
Employment	Pearson Correlation	.081	1
	Sig. (2-tailed)	.476	
	N	80	80

Table 5. 11 Test for correlation value added (income) and employment among palm fruit Processors

Source: Author's field survey, March 2014

Again, it is desired to test whether there is a relationship between income and employment in the palm kernel processing industry. The correlation analysis performed, in view of this test, establishes that there is a significant ($p < 0.05$) positive relationship between income and employment in this industry. Unlike the palm oil industry, it could be seen in the kernel industry that the higher the level of employment, the higher the income generated and vice versa (Table 5.12).

		Correlations	
		value_added	Employment
value_added	Pearson	1	.49
	Correlation		9**
	Sig. (2-tailed)		.00
			5
employment	N	30	30
	Pearson	.49	1
	Correlation	9**	
		.00	
		5	
		N	30

** . Correlation is significant at the 0.05 level (2-tailed).

Table 5. 12 Test for correlation value added (income) and employment among palm kernel processors

Source: Author's field survey, March 2014

Furthermore, at every stage of the oil palm value chain, people are employed to engage in various value addition activities. OPRI for example operates its oil palm plantation and nursery with labour force comprising of labourers, drivers, artisans, and technicians, clerks and other categories of administrators, technical and research officers including a director. At GOPDC a total number of 3,075 labour forces were employed. The number of labourers who undertake various value addition activities in the nursery, plantation, and out grower extension were 1,395, and 251 people work in the mill, 47 people were employed at the workshop, 63 at the transport department and 1,110 workers were

employed at the Okumaning estate. Other supporting staffs, making a total of 69 workers were employed as administrators, laboratory technicians, and research officers (GOPDC Management, 28/02/2014, Kwae town). In addition, since very nearly all the employees of GOPDC, OPRI and medium scale mills were Ghanaians drawn mostly from the locality where their establishments are located, it appears reasonable to assume, that the employment was having a positive effect on the rural socio-economic situation by enhancing incomes, curbing rural-urban drift, and improving technical and agricultural skills through the experience acquired on the job in the estates and from the training programs mounted by the companies especially the GOPDC and Serendipalm Company Limited for outgrower farmers.

5.5 Factors Accounting for Increased Income and Employment by Adding Value to the Palm Fruits and Kernels

Factors such as years of processing of palm oil, type of palm oil produced, type of fruit used to produce palm oil and level of education of producers among others were identified as some of the factors that could influence the level of income of palm oil producers. The analysis therefore sought to determine the extent to which these factors could influence income levels in the industry. Thus, this section looks at other activities which are essential to stimulate income through processing. With regards to the type of fruits used for processing palm oil, table 5.13 shows that 68.8% of processors use any type of palm fruit, 18.8% use 'tenera' fruits and 12.5% use 'dura' fruits. It was also realized that 43.8% of processors generated palm fruits from their farms and other private smallholder farms followed by 30% of processors who sourced their fruits from private farms. Therefore, a total of 68.8% of processors who used any type of fruit for producing palm oil and the different sources from which they generate palm fruits is a

sign that, it is not every processor who produces oil with improved fruits. This will likely affect the amount of income generated because only a few small holder farmers cultivate improved oil palm in the study area (Adjei-Nsiah *et al.*, 2012a). The situation differs because some palm fruits processors get their fruits from: OPRI and private farms (12.5%), OPRI, own farm and private farms (7.5%), OPRI and own farm (5%) and own farm (1.3%).

Source of fruits	Tenera	Dura	Any type of fruit	Percent
1. Own source	0	0	1	1.3
2. Private farm,	4	3	17	30.0
3. OPRI and own farm	2	0	2	5.0
4. OPRI, and private farm	1	0	9	12.5
5. OPRI, own farm and private farm	0	0	6	7.5
6. Own farm and private farms	8	7	20	43.8
Total use of fruit	15	10	55	100
Percent use of fruit variety	18.8	12.5	68.8	100

Table 5. 13 Distribution of sources and types palm fruits used for production

Source: Author's field survey, March 2014

With regards to kernel processing, majority (70%) of kernel processors responded that their sources of palm kernels were from small scale mills, 10% obtained kernels from

house to house and 17% indicated others (Figure 5.5). They explained that they obtained palm kernels from small scale mills and houses in the communities. Thus, it can be inferred that kernel processors process any type of nuts because they obtain it from any small scale palm fruit processor. This can also be an indication that they may be processing ‘dura’ types of palm kernels which is more advantageous in producing kernel oil.

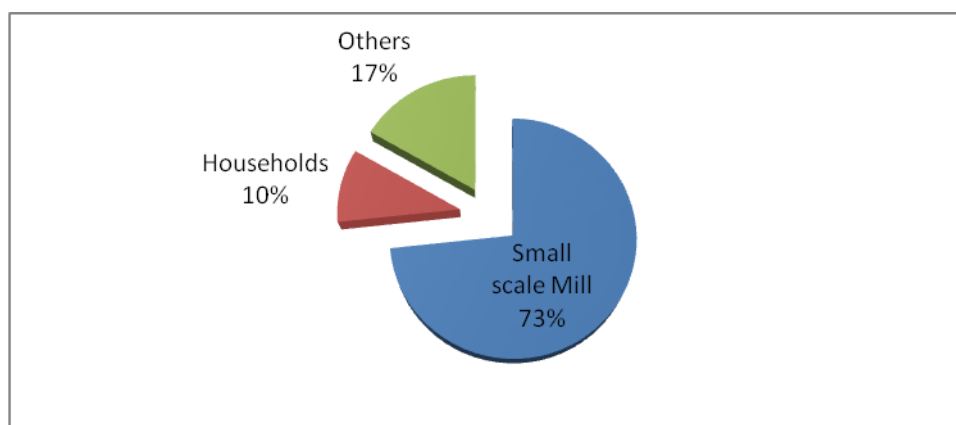


Figure 5. 5 Percentage distribution of raw material for kernel processing

Source: Author's field survey, March 2014

In terms of locational distribution of the use of improved fruit called ‘tenera’, figure 5.6 & 5.7 shows the percentages of processors who use ‘tenera’ fruits in the five selected communities. These are as follows: Kwae (8.8%), Kusi (6.25%), Kade (3.8%), Asuom (2.5) and Subi (1.3%). The fact that Kusi and Kwae have relatively high percentage use of ‘tenera’ fruits can be attributed to the proximity of these communities to OPRI and GOPDC. It may also be as a result of the fact that processors were able to purchase fruits from OPRI. It could also be that the presence of OPRI and GOPDC could have had significant effect on the use of improved planting materials. In the case of Kade and Asuom, it could also be inferred that either production practices of GOPDC have had a

trickle effect on farmers in the area. Perhaps, it may be that some out-growers sell or give parts of their fruits to relations to process.

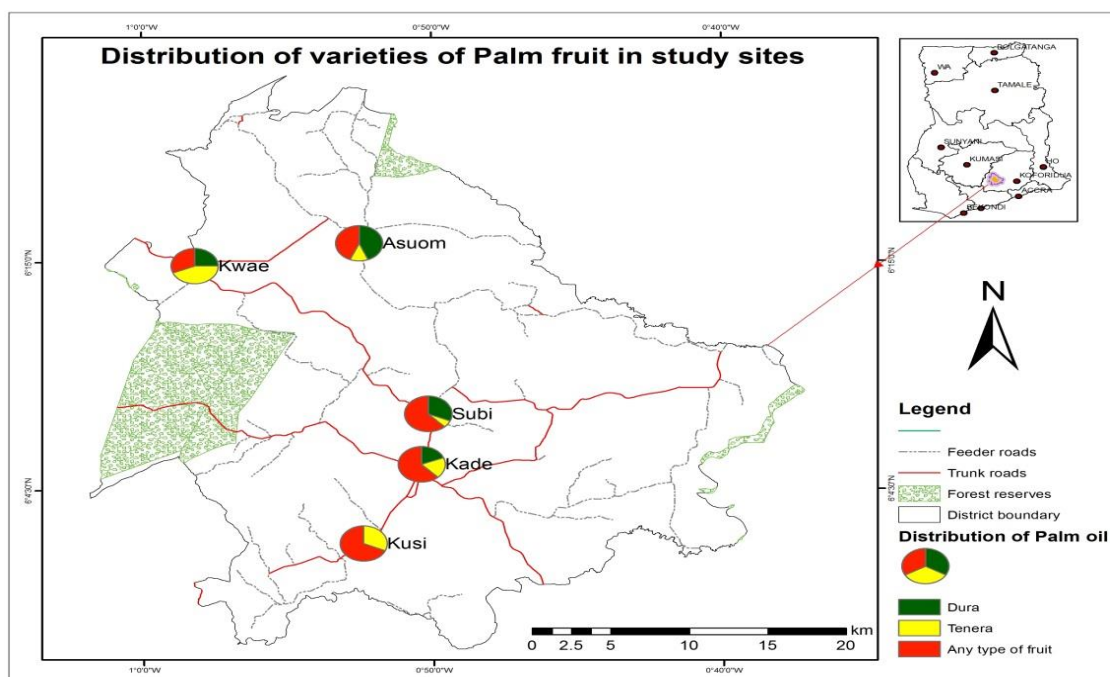


Figure 5. 6 Distribution of the use of varieties of palm fruits in the study sites

Source: Author's Field survey, March 2014

Taking the analysis a step further in order to verify the source of the palm fruits mostly used in the five communities, it can be realized that none of the processors use palm fruits from a single source. This may also be attributed to the scarcity of palm fruits in the five selected communities or due to the quantities that ought to be processed. However, the fact that 68.8 % of processors indicated that they use any type of fruit can be an indication that they may be aware of the importance of 'tenera' fruits. But issues of proximity, availability and competition for fruits especially in the lean season could have driven processors to use any kind of fruit so that they can remain in business.

Figure 5.7 expounds on the distribution of the various types of oil produced in the sampled communities. It can be seen that generally palm fruit processors produce any

type of oil in the five communities selected for the study. However, some of the communities have specialized in adding value to the oil or palm fruits in various ways.

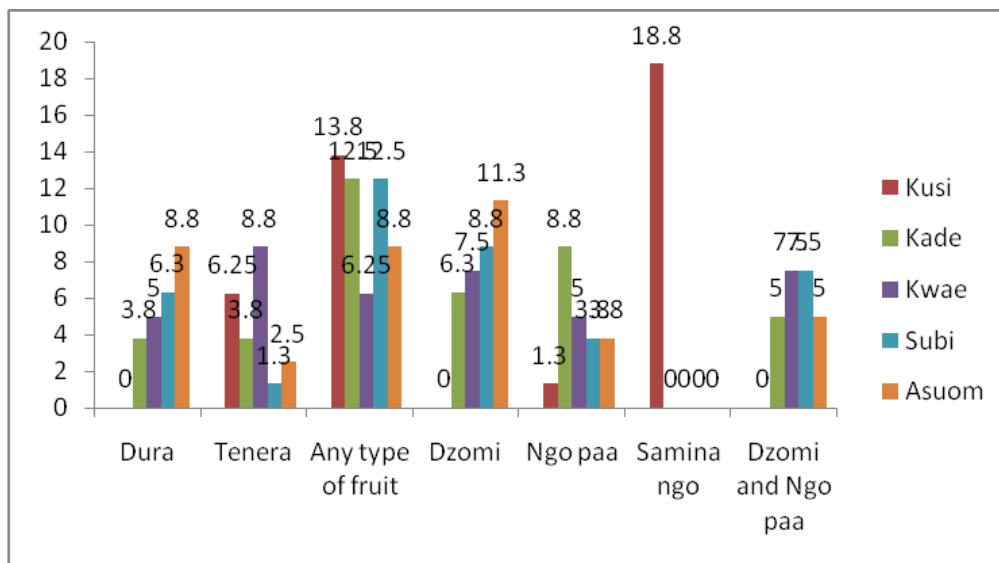


Figure 5.7 Distribution of palm fruits and types of palm oil

Source: Author's field survey, March 2014

On figure 5.7 & 5.8 for instance, Asuom has 11.3% of processors producing 'dzomi'. Also, at kusi, 18.8% of processors produced 'samina ngo' (fermented oil). In addition, at Kade, 8.8% of respondent were producing 'ngo paa'. However, in spite of the fact that Asuom has 11.3% of processors producing 'dzomi', Kwae and Subi also have 7.5% and 6.3% respective productions of 'dzomi'. It can also be realized from figure 5.7 that, all the processors do not produce 'samina ngo' (fermented oil). Because, in reality almost all the palm fruit processors generate fermented oil with the exception of respondents who use the combine digester and screw press. 'Samina ngo' is not produced on purpose but it is produced based on the type of equipment used by processors (see section 4.1.4); so, it is only Kusi community which purposely produces 'samina ngo'.

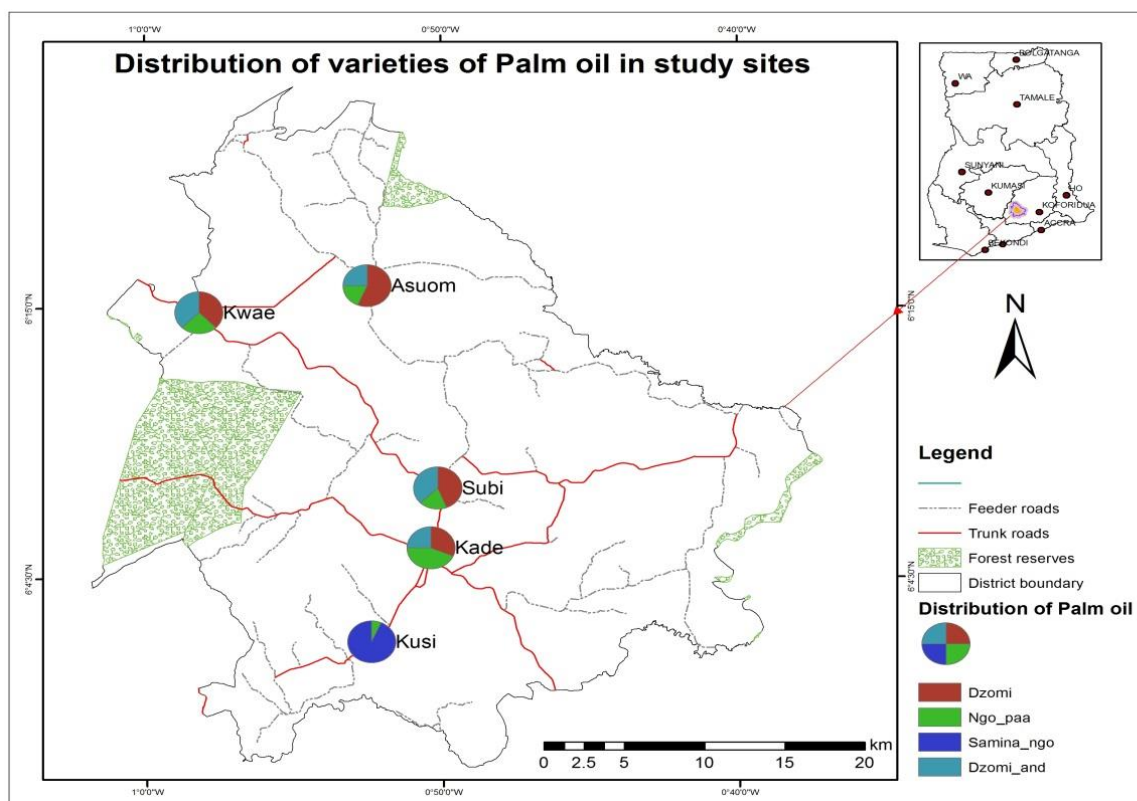


Figure 5. 8 Distribution of varieties of palm oil in the study site

Source: Author's field survey, March 2014

Further analyses were carried out on the other factors of production (namely: type of palm oil produced, type of fruit used to produce palm oil and level of education of producers) to assess whether they had any significant effect on income in the palm oil industry. The analysis of variance (ANOVA) which is used to determine whether there is any significant difference in the average values of two or more factors was performed on each of the factors of production as mention above. With regards to the type of fruit used for the palm oil, the ANOVA performed (with p-value of 0.517 (see appendix 3) revealed that there was no significant difference in income obtained from the sale of palm oils obtained from these fruits. Even though respondents who used Dura palm fruit seemed to have recorded quite a larger income (see appendix 2), the analysis indicate that, on the whole, the income levels were approximately equal regardless of the type of fruit used.

In addition, there was no significant difference in income levels as far as level of education was concerned. This is to say, that, the level of one's education was not a determinant of one's income in the industry. The p-value associated with the ANOVA for income on level of education is 0.786 ($p > 0.05$) (see appendix 3). That aside, the income equalities identified with the aforementioned factors of production, the analyses (with p-value of 0.000, see appendix 3) revealed that there were very significant disparities in income according to the type of palm oil one produced. Furthermore, the descriptive statistics presented on appendix 2 gives an indication that, producers of both '*dzomi*' and '*ngo pa*' were the highest income earners in the industry (with an average of GH¢673.50). This is followed by producers of '*dzomi*' who earned an average of GH¢626.20. There was however, no significant difference in incomes earned by producers of '*samina ngo*' and '*ngo pa*' as they reportedly earned GH¢574.40 and GH¢562.00 respectively (see appendix 2). Finally, just as the case of the palm oil industry, the educational level of respondents, was identified as not being a significant determinant of income in the palm kernel industry. This is p-value of 0.227 associated with the ANOVA output is not significant at the 0.05 level of significance (see appendix 3). Therefore, ANOVA test conducted on the type of fruit used for producing palm oil and the type of palm oil produce annulled the second proposition in the study that adoption of innovative strategies sustains value addition (income).

5.5.1 Regression of Income on Years of Oil Processing in the Palm Oil Industry

The analysis also sought to determine whether years of processing palm oil is a factor of production that could have any significant effect on the income generated. The regression analysis performed in this respect, which returned a non-significant p-value of 0.687, indicated that the years of oil processing did not have any significant influence on

income generated from the product (palm oil). That is to say that the number of years of being in business could not determines one's income level in the industry (appendix 4).

5.5.2 Regression of Income on Years of Oil Processing in the Palm Kernel Industry

The regression analysis performed in this regard proved to be significant (with p-value of 0.019, see appendix 5) at the 0.05 significance level. Unlike the situation of the palm oil industry, the number of years of palm kernel processing as a factor of production was identified to be a significant determinant of income in the (palm kernel) industry. Stated differently, the analysis revealed that the more years spent in the industry, the more income processors can realized from the sale of the product. Though years of production has been identified by the regression performed to be a significant predictor of income, it is however not a key determinant of income. This is because the R-square (which measures the amount of variability in income that is attributable to years of oil processing) is only 18.3% (Table 5.14). The remaining 81.7% is attributable to other factors.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.427 ^a	.183	.153	326.75725
a. Predictors: (Constant), Years of processing kernels				

Table 5. 14 Regression of the level of income and years of processing palm kernel
Source: Author's field survey, March 2014

Finally, just as the case of the palm oil industry, the educational level of respondents, was identified as not being a significant determinant of income in the palm kernel

industry. The p-value is 0.227 associated with the ANOVA output is not significant at the 0.05 level of significance (see appendix 7).

5.6 Multiplier Effects of Value Addition to Palm Fruits and Kernels in the Oil Palm Industry

The benefits derived from processing palm fruits and kernels as indicated by small scale oil palm processors include: income (38.3%), employment (42.5%), industrialization (34.2%), raw material (12.1%), export promotion (21.3%), revenue generation (28.8%) and others (23%). Table 5.15 shows that majority of the processors agreed to the fact that value addition to the palm fruits and nuts have the capacity to create employment and increase income of processors. Respondents who choose other options provided indicated various benefits derived from adding value to the palm fruits and kernels. These benefits were: diversification of livelihoods and income sources; use of local knowledge, waste reduction in the natural environment through reuse and recycling; and local development.

Processors	Income	Employment	Industrialisation	Raw material	Export promotion	Revenue generation	Other benefits
Palm fruit	25%	22.5%	17.5%	8.8%	11.3%	8.8%	6.3%
Palm kernel	13.3%	20%	16.7%	3.3%	10%	20%	16.7%
Total	38.3%	42.5%	34.2%	12.1%	21.3%	28.8%	23%

Table 5. 15 Benefits derived by small scale palm fruit and kernel processors through value addition

Source: Authors field survey, March 2014

Respondents indicated that income generated from processing palm fruits and kernels were used for: purchasing food for their households (27.5%); healthcare needs (44.6%); school supplies (50.5%); paying back credits (23.3%); buying household assets (19.6%); and (34.6%) for others (see Table 5.16). The respondents, who choose the option captioned others, specified that they use the income to pay rent and utilities, fulfill ceremonial and religious duties. The fact that 50.5% and 44.6% of respondents use most of the income to cater for healthcare and educational needs shows how income generated is put to use in the oil palm industry.

Processors	Food for Household	Healthcare	School	Paying	Buying household assets	Other socio-economic needs
Palm-kernel	10%	23.3%	26.7%	3.3%	13.3%	23.3%
Palm fruit	17.5%	21.3%	23.8%	20%	6.3%	11.3%
Total	27.5%	44.6%	50.5%	23.3%	19.6%	34.6%

Table 5. 16 Distribution of income to meet socio-economic needs

Source: Author's field survey, March 2014

5.6.1 Implication of Value Addition for Socio-economic Development

Processors were asked to indicate the industries or businesses with which they were connected to for the purpose of purchasing and supplying goods in the mill. They indicated that they have established network with other sectors in the study area. The percentage distribution of these linkages is as follows: plastic industries (72%), aluminum industries (33%), and metal and fabrication industries (30.2%). Other respondents (22.3%) indicated that they had connections with the petroleum industry, (8.1%) to agrochemical industries and (59.3%) mentioned other industries (Table 5.17). Other respondents expatiated that these industries include: telecommunications

industries, automobile industries, alcoholic and distilleries, Electricity Company of Ghana, food and water industry, and wood carving industries. Other sectors mentioned comprise of research institutes, banks and financial institutions, soap processing industries, building and construction industries. Various institutional heads also revealed in interviews that value addition in the oil palm industry leads to many connections to the Environmental protection Agency, Wildlife, and Water resource commission. Others include books, stationary and printing press, broom makers, chemical industry, garment, quantity surveyors and textile industry. These are connections that processors have with the wider economy.

Table 5. 17 Connections of value addition activities of processors to other industries
Source: Author's field survey, March 2014

Processors	Plastic industries	Aluminum Industries	Metals and fabrication	Petroleum Industries	Agrochemical industries	Other industries
Palm kernel	52%	18%	15.2%	14.8%	1.8%	13%
Palm fruit	10%	15%	15%	7.5%	6.3%	46.3%
Total	62%	33%	30.2%	22.3%	8.1%	59.3%

The linkages establish with other sectors of the economy is not particular to the small scale palm and kernel processors. In an interview with other actors in the oil palm industry ranging from the OPRI, nursery units, small holder farms, plantations and medium scale mills, they indicated that in their quest to add value to oil palm, palm fruits, kernels, palm and kernel oil, they collaborate with other industries. The actors in the oil palm value chain maintain linkages with the rest of Ghana and the world at large. The linkages are both forward and backward, and assume the form of flow of labour, money, and commodity flows, notably palm oil and kernel oil, and refined palm oil products. Others include transfer of technology and managerial expertise. Their

significance lies mainly in their effects on the local and national economy. Virtually almost all the machines used by GOPDC, medium mills are imported and some small scale equipment made in the farming locality. The evident of this relationship demonstrates how international linkages of this sort stimulate national development.

Ghana Oil Palm Development Company is the only large scale oil palm plantation in the Kwaebibirem District. GOPDC carry out value addition practices starting from the use of improve planting material to the ultimate distribution of refined products to its customers. As a result value addition practices on the plantation, additional hands have been employed. The salaries paid to employees are used to feed their family, pay school fees, and health needs of the family. This brings more money to the local economy. Through the introduction of value addition practices in their production, people who are employed from the communities within GOPDC enclaves have learnt value adding skills which have been relevant to crop production on their own farms. This leads to increase productivity, income and employment.

Source: Author's field survey, March 2014

Box 1 A snapshot of the contribution of value addition to socio-economic development

An increasing important linkage between the estates and their adjoining rural economy is supply of palm fruits, palm kernels, kernel shells from the small and medium scale farms and mills to GOPDC. It can be said that the supply of resources to the estate and medium scale company may be contributing significantly towards commercialization of the local economy. The greatest proportions of GOPDC products are sold to local and international industries for refined value added products such as soap, margarine, candle, cooking oil and so on. As indicated in chapter 4, small scale processors produce a special type of palm oil and kernel for local soap makers and export market in some West Africa countries. Thus, value addition in GOPDC and in the small scale mills may be

contributing significantly towards Ghana's industrialization drive through supplies of raw materials to small and large processing industries in the rural and urban areas. It can therefore be asserted that GOPDC, medium and small scale processors and exporters have been earning foreign exchange for the country through the export of palm and kernel oil, and other refined oil palm oil products. Apart from the fact that actors in the oil palm industry have connections with other industries in the local and national economy, modern infrastructures and entertainment facilities are provided to enhance value addition in the farming localities. Therefore, value addition in agriculture can be said to a means by which infrastructural development is brought to farming localities. For instance, GOPDC has modern housing facilities, schools, clinics, hospitals, club houses and various other recreational facilities located in its estate to support farmers and its workers. This goes back to emphasize a conjuncture made for the study that value addition in the oil palm industry, leads to the growth of other industries in the farming localities.

These connections are also indicative of the growth of other business and increased employment. The linkages established among other sectors of the economy and oil palm actors have a possibility of influencing socio-economic development. This is due to the amount of income, employment and other multiplier effects it has on other activities in the study area. These findings confirm the third proposition stated in the study that increase in income generated through value addition results in the spread of industries, diversification of livelihood options, and waste reduction was found to be evident in the oil palm industry in Kwabibirem District.

Serendipalm Company Limited is a medium scale organic palm fruit processing mill at Asuom. Organic farming is a value addition strategy; hence, the company supplies certified organic palm oil to its customers in the United State of America. Farmers are paid 10% higher than the standard buying price in the district for cultivating the organic oil palm. Consumers abroad also pay 10% rate higher than the normal world market price. This is because they are aware that they buy from organic and fair trade farmers. The extra income raised from this activity is used solely for promoting socio-economic development in the area. This is done through the provision of boreholes at Abodom, Asuom, and Bomso; provision of outboard motors for communities at Kukubaam, and construction of Abaam nurses quarters.

Aside these projects, jobs have been created for a large number of women at Asuom. These women are employed to remove fruits manually from the spikelet. The number of people employed in the company is about 100 people, 68 casual workers and 32 permanent workers. The intent of the organic project is a 'win win' strategy for the company and the communities as well. Thus, interest-free loans, seedlings, knives, harvesting poles and cutlasses are given to farmers. Sound extension services are given to farmers to add value in their production. The socio-economic effect of organic oil palm farming as a value added strategy is that farmers have seen significant improvement on palm fruit yield. They have also derived health, and environmental benefits. Therefore, the idea of adding value to the oil palm and palm fruit through organic means has contributed numerously to socio-economic development in Kwaebibirem district.

Source: Author's field survey, March 2014

Box 2 A snapshot of the contribution of value addition to socio-economic development

The foregoing discussion on the benefits and the uses of income derived from processing, packaging and marketing palm fruits and kernels as value addition strategies implies that rural women and men will be empowered economically to meet family responsibilities.

5.7 Conclusion

This chapter focused on processing of palm fruits as a value addition strategy and the socio-economic benefit derived from it. Summary of findings shows that palm and kernel processors generate net profit of GH¢375.72 (\$ 143.88) and GH¢131.64 (\$ 50.41), respectively from adding value to palm fruit. It was also revealed that processors employ average number of 8-10 people to process 1 tonne of palm fruit and kernel. The study also found out that value addition through processing leads to development of linkages with other industries in the study area. Finally, the study established that value addition has significant effects on income, employment leading to the development of other economic activities in the local economy.

CHAPTER SIX

IMPLICATIONS OF VALUE ADDITION IN THE OIL PALM INDUSTRY FOR AGRICULTURAL POLICY

6.0 Introduction

This chapter presents summary of findings, conclusions and recommendations.

6.1 Summary of Key Findings

In this study, a questionnaire survey, interviews, group discussions, and observation were used as tools to address the issue of value addition in relation to socio-economic development in the oil palm industry. Below are key findings concerning the objectives of this study.

6.1.1 The character of the activities that generate value in the oil palm industry

Value addition activities in the oil palm industry were divided into three main areas. It was realized that upstream value addition activities starts with OPRI as the pillar of the oil palm industry because it produces improved planting material called 'tenera'. Various value addition practices were carried out in the oil palm nurseries and plantations. They comprised of application of agrochemicals, organic manure, cover cropping, mix cropping, mulching and harvesting of palm fruits with improved equipment.

In the small scale mills, processors add value to the palm fruit by leaving it to ferment for some days before processing it. This action is perceived to reduce the amount of moisture in the fruits leading to increase yield in oil. However, in GOPDC, prompt processing of palm fruits is carried out within 48 hours of harvesting to arrest the formation of free fatty acid (FFA) in the oil. It was also recognized that processors heap

fibers for 3 days after pressing palm oil from digested fruits. Fibers are pressed again to generate fermented oil which is used purposely for soap production. Value is added to waste generated in the mill by using it as fuel for boiling palm fruits. It is understood that value is also added to kernels by recovering it from the fiber before it is sold to kernel processors. Furthermore, disconnection in the chain of production is identified among kernel processors.

Midstream value adding activity identified in the study is refining of crude palm and kernel oil into olein, stearin, deodorized oils, and bleached oil at GOPDC. Refined products were bulked and sold to industries outside Kwaebibirem District. Local end-use of crude palm and kernel oil were identified to include: the use of crude palm and kernel oil for local dishes, local soaps, alcohol and many others. After the analysis of value addition in the oil palm industry, it was realized that the chain of activities in the oil palm industry depicted a value web due to back and forth flow of resources within various sectors of the industry.

6.1.2 Contribution of value addition to employment and income

The net profit approach is used to quantify average value added (income) from processing of palm fruits and kernels. It is realised that processors generate an average profit of GH¢ 375.72 (\$143.88) per a tonne of palm fruits and GH¢ 131.64 (\$ 50.41) on 1 tonne of palm kernel. The amount generated by both groups of processors confirms the hypothesis that value addition is a profitable activity. In terms of the contribution of value addition to employment, the average number of people employed to process 1 tonne of palm fruit and kernels is 10 and 8 peoples respectively. The amount of income and employment generated through value addition in processing palm fruit and kernels proved the economic contribution of value addition to socio-economic development in

Kwaebibirem District. Interviews revealed that, it is not economical to produce 1 tonne of palm fruits and kernels. Thus, as more quantity of palm fruits and kernels are produce, the number of employees needed to assist in production also increases. As value addition in the oil palm industry entails growing income and employment, other industries such as plastic, aluminium, energy, metal works and other industries have also evolve. Therefore, the third proposition, which states that value addition results in growth of other industries in Kwaebibirem district has been confirmed in the study.

6.2 Conclusion

From the value chain theory adopted for the study, it is understood that value addition in the oil palm industry is demand driven. In the oil palm value chain lies OPRI, individual nursery farmers, GOPDC, medium scale palm oil processors, small scale processors, labourers, traders and industrial manufactures. Each of these actors are situated at a specific section of the production chain; namely, Upstream, Midstream, and downstream. Major finding of the study corroborates with other studies conducted on value addition in agriculture that innovative initiatives adopted in a production system increases income, generates employment, and reduces poverty leading to the realization of socio-economic development. Interventions that will enhance value addition in the oil palm industry were not in existence. Hence, actors in the oil palm value chain were not able to accrue all the profit in their activities. Recommendations are made in this regard in subsequent subsections.

6.3 Policy Implication for Agricultural Production in Ghana

Results generated from the study have shown that lots of issues hinder value addition in the oil palm industry. The challenges discovered in this study provide a stand to offer practical recommendations that will influence policy.

6.3.1 The Critical Role of Research in Agriculture

There is a need to focus research activities on innovative ways of adding value to agricultural products. The study suggests expansion in agricultural research activities; and where possible, research should also be focused some foreign crops that have niche markets in Ghanaian food and hospitality industries. Alternatively, research activities in agriculture can have a specific section that will investigate value addition initiatives in collaboration with local experts.

6.3.2 Extension and dissemination of information to farmers and processors

Extension services should convey research findings to farmers in farming localities. Their responsibilities should also include aiding farmers to locate value adding farm inputs. This will assist farmers or processors to easily adopt value adding technologies. Extension officers can also establish local verification trails to ensure that farmers adopt technically sound, economical, profitable and acceptable innovations under local conditions. Local verification trails should involve farmers to find out best practices under production and price conditions.

6.3.3 Nationwide distribution of improved planting materials

The study suggests that farmer's yield can be increased through wider distribution of improved planting materials. This can be carried out by establishing national seed services and nurseries centers in farming localities. Government can also subsidise the prices of improved seeds or seedlings to farmers. Government can also offer free equipment, agro-chemicals and other necessary input infrastructures to farmers in areas which have been identified to be adding little value in their production system.

6.3.4 Enhancing Agriculture through Investment in Infrastructure

Infrastructures such as irrigation facilities, good road network, production and processing equipment, energy resources among other things must be made available to farmers or processors. Technologies design for farmers should also be fashion in ways that will appropriate to rural needs. Construction of rural roads should be accelerated; and deteriorated roads should also be reconstructed in order to reduce the cost of flow of goods, information and other rural services to farming communities.

6.3.5 The Use of Efficient Technology

Farmer-processors income can be improved through the provision of efficient processing equipment. In this case, the Ghana Regional Appropriate Technology Industrial Services (GRATIS Foundation) or Rural Enterprise Project (REP) should design equipment which suits, farmer-processors financial status, gender, and energy sources. There is the need to also design automatic equipment into some aspects of agriculture production and agro-processing stages to make value addition attractive to farmers and processors.

6.3.6 Developing the Capacity for Healthy Agro-Food Processing

The growing demand for agricultural products in the domestic and international market calls for a need to ensure that farmer-processors adhere to standard procedure in the food industry. It is expedient that the state invest in projects and institutions to provide technical assistance to stimulate quality and standard food production. In addition, an appropriate institution should be entrusted with the mandate to ensure that small scale agro-food processors adhere to standard procedures in their production. This institution should have systems of accreditation, conformity assessment, labeling and certification for small scale processors. Other functions of the institution should include: development in traceability management system; and investment in human scientific resources.

6.3.7 Environmental and Natural Resource concerns

Another pertinent issue that should be addressed is in relation to environmental sustainability in the process of adding value in agricultural sector. Farmers should be encouraged to practice organic farming. They can reuse waste generate on the farm or mills to replenish soil nutrient. The concept of recycle and reuse can be underscored to agro-processors in order to reduce the amount of waste they generate in the natural environment.

6.3.8 The Use of Standard Scale

In order to increase the amount of income generated by small scale farmers and processors in Ghana, a standard scale or weight should be introduced to quantify goods sold at an exact price. This can be made by enacting a law on the use of standard scale for selling agricultural products on the farm, agro-processing mills and, in rural and urban markets.

6.3.9 Active Role of Public Institutions

State institutions such as Business Advisory Centers (BAC); Rural Enterprise Project (REP); and National Board for Small Scale Industries (NBBSI) should play active roles by organising seminars or training programs for farmers-processors. Training programs should be based on how farmers or processors can develop marketing and business strategies, and basic accounting and numeracy skills. Knowledge on business development skills will enable them to accrue more income. Training programs will also encourage agro-processors to engage in innovative value adding activities or improve upon existing skills.

6.3.10 Innovative Marketing and Distribution of Agricultural Products

The study suggests that innovative marketing centers should be established in farming localities. Marketing centers may serve as appropriate places for farm products and farm supplies to be exchanged. Marketing centers will be places where farmers can bring their products to be scaled and obtain suitable prices. The centers may be structured in a way that buyers will come and register for the quantity and characteristics of goods required. Then officials in charge of marketing centers will inform farmer-processors on the total products required for a marketing day (Rahko, 2012). When this is well carried out, a situation whereby farmers and processors wait for buyers with any type of price be eliminated.

In addition to the establishment of marketing centers, marketing strategies such as niche marketing, direct marketing, roadside markets, farm banks, farmers stand, and community markets should be promoted to enhance farmers or agro-processors income. Other value adding strategies that can be adopted by farmers or agro-processors are product differentiation or diversification, agri-tourism, regional branding, bread and breakfast farm accommodation, and farm festivals.

6.3.11 Investment in Agro-industries

Policy on public-private partnership should encourage industries to locate close to farming localities where raw materials are readily available. This will enable high value added productions to be carried out close to sources of raw materials. Therefore, infrastructures should be made available and taxes exempted to serve as incentives for industries to locate close to farming areas. This will serve as an avenue for providing employment for rural dwellers.

REFERENCES

- Abdullah, N., & Sulaiman, F. (2013). The Oil Palm wastes in Malaysia: Biomass Now-Sustainable growth and use. Retrieved September 20, 2013 from <http://dx.doi.org/10.5772/55302>
- Ackermann, N. (2010). Adding value to traditional products of regional origin. A guide to creating a quality consortium. United Nation Industrial Development Organization
- Adjei-Nsiah, S., Sakyi-Dawson, O., & Kuyper, T. W. (2012a). Exploring opportunities for enhancing innovation in agriculture: The case of oil palm production in Ghana. *Journal of Agricultural Science*, 4 (10).
- Adjei-Nsiah, S., Zu, A. K. S., & Nimoh, F. (2012b). Technological and financial assessment of small scale palm oil production in Kwaebibirem District, Ghana. *Journal of Agricultural Science*, 4 (7).
- Aghalino, S. O. (2000). British colonial policies and the oil palm industry in the Niger Delta region of Nigeria, 1900-1960. *African Study Monographs*, 21(1), 19-33.
- Amanor-Boadu, V. (2003). *Preparing for agriculture value-adding business initiatives: First things first*. Agricultural economics and marketing resource center, Kansas State University. Retrieved September 30, 2012 from www.agecon.ksu.edu/accc/kcdc/.../Value-Added%20Concept.pdf
- Amoa-Awua, W. K. (2002). *Value addition to indigenous African foods*. Retrieved December 10, 2013 from <http://www.intranet.foodresearch.org:8080/library/handle/0/635>
- Anjum, F. M. [n.d]. Value addition in Pakistan- challenges and opportunities. National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan.
- Ajani, E. N., Onwubuya, E. A., & Nwalieji, H. U. (2012). Assessment of oil palm production and processing among rural women in Enugu North Agricultural zone of Enugu State, Nigeria. *International Journal of Agricultural Sciences*. 2(12), 322-329.
- Asante, E. A. (2012). The case of Ghana's President's Special Initiative on oil palm (PSI-Oil Palm) DIIS Working Paper 2012:11.
- Awua, P. K. (2000). Upstream processing of agricultural produce: prospects and challenges for Ghana's economic development. *Journal of Ghana Science Association*. 2(3), 46-69.
- Basiron, Y. (2007). Palm oil production through sustainable plantations. *Eur. J. Lipid Sci. Technol.* 3(109), 289-295.
- Basiron, Y., Balu, N., & Chandramohan, D. (2004). Palm oil: The driving force of world oils and fats economy. *Oil palm industry economic journal*. 4(1).

- Benso Oil Palm Plantation Limited public share offer prospectus (2003). Retrieved September 23, 2013 from <http://www.gse.com.gh/.../PR%20-%20185%20%20BOPP520Un-audited%20>.
- Bergert, D. L. (2000). Management strategies of *Elaeis Guineensis* (oil palm) in response to localized markets in south eastern Ghana, West Africa. Master thesis, Michigan Technological University.
- Boehlje, M. D., Hofing, S. L., & Schroeder, R. C. (1999). Value chains in the agricultural industries. Staff paper 99-10.
- Born, H. (2001). Keys to success in value-added agriculture. Published by Southern Sustainable Agriculture working group and The National Center for Appropriate Technology.
- Bonney, E. (2012). MOFA launches oil palm master plan. Daily graphic Wednesday, July 11, 2012.
- Bradley, R. (2012). Resourceship: Expanding 'Depletable' Resources. Library of economics and liberty. Retrieved from March 12, 2013 <http://www.econlib.org/library/columns/y2012/Bradleyresourceship.html>.
- Carrere, R. (2013). Oil palm in Africa: Past, present and future scenarios. *World Rainforest Movement series on tree plantations 15*. Retrieved May 20, 2014, from http://www.wrm.org.uy/wp-content/uploads/2014/08/oil_palm_in_Africa_2013.pdf.
- Chege, J. (2012). Value addition in coffee industry in Kenya: Lessons from cut flower sector. ICBE-RF research report No. 21/12.
- Coley, R.H.V. & Tinker, P.B.H. (2003). The oil palm. New York, Wiley publications
- Craig, B. S., & Brown, S. G. (2002). Producing value-added products for market: start with food safety. Published by Washington State University, 2002.
- Coltrain, D., Barton, D., & Boland, M. (2000). Value added: Opportunities and strategies. Retrieved August 20, 2013 from <http://www.agecon.ksu.edu/acc/kcdc/PDF%20Files/VALADD10%202col.pdf>.
- Creswell, J.W. (2012). *Educational research: Planning, conducting and evaluating quantitative and qualitative research* (4th ed). Boston, Pearson Education.
- Cutis, K. R., & Cowee, M. W. [n.d]. Value-added opportunities for Nevada agriculture. Fact sheet-05-33. Retrieved August 20, 2013 from http://www.naes.agnt.unr.edu/PMS/CVs/Cowee_M_2013_523.pdf.
- Danielson, R., & Park, D. (2001). Value-added, on-farm processing. North Dakota State University, 2001. Retrieved August 20, 2013 from www.und.nodak.edu/org/.../case%20study%2011.summer's%20harvest.p.
- Danyo, G. (2013). Oil palm and palm oil industry in Ghana: A brief history. *International Research Journal of Plant Science*. 4(6) 158-167.

- Dauda, S., Biney, S. O., & Mensah, C. A. (2013). Urban environmental injustice in Ghana: The activities of small-scale palm oil producers in the Ahanta West District. *International Journal of Development and Sustainability*. 2(3).
- Deitz, R., & Cowell, M. (2005). How New York State's agriculture industry is staying competitive. The regional economy of upstate New York. Retrieved June 30, 2013 from http://www.newyorkfed.org/research/regional_economy/upsate/spring05.pdf
- Dickson, K. B. (1969). *Historical Geography of Ghana*. Cambridge University press.
- Docherty, C. (2012). Branding agricultural commodities: the development case for adding value through branding. Topic brief series.
- Eathington, L., Swenson, D., & Otto, D.M. (2000). Employment in Iowa's agricultural commodity processing industries. 1992-98, Department of economics, Iowa State University
- Ernst, M., & Woods, T. (2011). Adding value to plant production- A summary of Kentucky products. University of Kentucky cooperative extension service, University of Kentucky. Retrieved 30, 2013 from <http://www.uky.edu/Ag/CCD/vakyproducts.pdf>
- Evans, E. (2012). Value added agriculture: is it right for me? Food and Resource Economics Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences. Retrieved June 30, 2013 from <http://www.fl.foodmarketmaker.com/uploads/2aca72eaa905abdf964a833ba94c51c0.pdf>
- Fairbairn, J., & Gustafson L. J. (2004). Value Added Agriculture in Canada: Report of the standing senate committee on Agriculture and Forestry. Retrieved June 30, 2013, <http://www.parl.gc.ca/./re02dec04-e.pdf>
- Fairhurst, T. H., & Mutert, E. (1999). Introduction to the production of oil palm. *Better Crops International* 13(1).
- Flemming, K. (2005). Value-added strategies: taking agricultural products to the next level. UH-CTAHR, AB.
- Fold, N., & Whitfield L. (2012). Developing a Palm Oil Sector: The experiences of Malaysia and Ghana compared. Retrieved November 30, 2012 from <http://subweb.diis.dk/graphics/Publications/WP2012/WP2012-08-Palm-Oil-Malaysia-Ghana-Whitfield-Fold-web.pdf>
- Foli, C. (2010). History of oil palm in Ghana. Report commissioned by the Ghana country team of the elites, production and poverty research program based at the Danish Institute for International Studies. Unpublished report.
- Ghana Shared Growth and Development Agenda (GSGDA). (2010). Retrieved from http://www.eease.europa.eu/delegations/ghana/documents/eu_ghana/ghana_shared_growth_and_development_agenda_en.pdf
- Ghana districts website The Kwaebibir District. Retrieved on 04/11/2013 from <http://www.ghanadistricts.net>

[Ghana Statistical Service \(2013\). 2010 population and housing census report. Non-monetary poverty in Ghana. Retrieved May 29, 2015 from http://www.gh.undp.org/content/dam/ghana/docs/Do/Inclgro/Non-MonetaryPoverty in Ghana \(24-10-13\).pdf](http://www.gh.undp.org/content/dam/ghana/docs/Do/Inclgro/Non-MonetaryPoverty%20in%20Ghana%20(24-10-13).pdf)

Ghana Statistical Service (2014). Ghana living standard survey round 6: Main report.

Ghana Oil Palm Development Corporation. (2012). GOPDC News. *The House Journal of GOPDC*. 23.

Gyasi, E. A. (1988). The Oil Palm Industry and Its Implications for Rural Development. *The Malaysia Journal of Tropical Geography* 18.

Gyasi, E. A. (1991). The oil palm industry and its implication for the rural economy in Ghana. Unpublished report, University of Ghana.

Gyasi, E. A. (1992a). Emergence of a New Oil Palm Belt in Ghana. Amsterdam, The Royal Dutch Geographical Society KNAG publications

Gyasi, E. A. (1992b). State expropriation of land for a plantation and its impact on peasant in Ghana. Proceedings of Commonwealth Geographical Bureau Indigenous Land Rights Workshop, Christchurch, New Zealand

Gyasi, E. A. (1996). *The environmental impact and sustainability of plantations in Sub-Saharan Africa: Ghana's experiences with oil-palm plantations*. In: Benneh, G., Morgan, W. B., and Uitto, J.I. (eds.) *Sustaining the future: economic, social and environmental change in Sub-Saharan Africa*, 342-357. The United Nations University Tokyo.

Gyasi, E. A. (2008). Emergence of a new oil palm belt in Ghana. *Journal of Economic and Social Geography*, 83, 23-41.

Hagerstrand, T. (1953). *Innovations*. (trans. A. Pred (1967) *Innovation Diffusion as a Spatial Process*, Illinois, University of Chicago Press.

Hamid, K. A. A. (2008). Production of cellulose fiber from oil palm frond using steam explosion method. Master's of thesis, Universiti Malaysia Pahang.

Hardesty, S. D. (2004). Agricultural cooperatives as effective marketers of value-added products. Research report NO.4 May 1992

Helmut, A., & Springer-Heinze, A. (2006). Value-added chains and agricultural trade. *Agriculture and Rural Development*.

Janssen, W. Hall, A., Pehu, E. & Rajalahti, R. (2010). Linking market and knowledge based development: the why and how of agricultural innovations systems. In Van Trijp & Ingenbleek (Eds), 44-53

Kanagawa, M., & Nakata, T. (2008). Rural Development issues. (Eds), *rural development issues*. New York, Nova Science Publications.

- Kaplinsky, R. (2013). Global value chains, where they came from, where they are going and why this is important. *Innovations, Knowledge and Development Working paper* (68).
- Kaplinsky, R., & Morris, M. (2000). *A handbook for value chain research*. Sussex, University of Sussex press.
- Kalu, O., Downing, J., & Field, M. (2006). Globalisation and the small firm: a value chain approach to economic growth and poverty reduction. AMAP BDS Knowledge and practice microREPORT #42, USAID/G/EGAT/MD. Washington, D.C.: ACDI/VOCA.
- Kibbe, T.F. (1996). Value-adding contract cooperatives: Investor and non-investor differences. Master thesis, Dakota State University of Agriculture and Applied Science
- Knop, S., & Tronstad, R. (2000). A guide to value-added agriculture and forestry enterprises: New gates through old fences. Colorado State University Cooperative Extension.
- Krell, R. (1996). Value-added production from bee keeping. FAO agricultural Services Bulletin No. 124, FAO Rome.
- Kwaebibirem District Assembly Profile (2006). Retrieved December , 2013 from <http://www.kwaebibirem.ghanadistricts.gov.gh>
- Leigh, A.Y. (2002). Agro-processing sector in Ghana, West Africa. *Carolina papers international development*. 5
- Lewis, J. L. (2002). How farmers in West Virginia are using value-added processing to increase annual income. Master's thesis, West Virginia University.
- Lynn, M. (1997). *Commerce and economic changes in West Africa: The palm oil trade in the nineteenth century*. Cambridge, Cambridge University Press.
- Malaysia Palm Oil Council (MPOC). (2009). Palm oil industry in Malaysia; skills and knowledge for sustained development in Africa. Retrieved from http://www.siteresources.worldbank.org/.../Malaysian_Palm_Oil_Industry
- MAFAP (2013). Monitoring African Food and Agricultural Policies, analysis of incentives and disincentives for palm oil in Ghana. Draft Version 2013.
- Maetzold, J.A. (2000). Alternative enterprises and agritourism resource manual. Ogden: USDA
- MASDAR (2011). Master Plan Study on the Oil Palm Industry in Ghana. Final report, revised November 2011.
- Mele, C. V., & Buschmann. (2013). Comparative analysis of mango value chain models in Benin, Burkina Faso and Ghana. In Aziz, E. (Eds.), In *Rebuilding West Africa's food potential: Policies and market incentives for smallholder-inclusive food value chains*. Rome, FAO.

- Mhango, Y. (2010). Ghana: Annual economic outlook, the eve of oil production. Accra: Standard Bank
- Mior, A. K., Mohd, R. Z., Hidayah, A., Mohd, N. M., Jailani, S., Yoshihito, S., & Mohd, A. H. (2012). Renewable sugars from oil palm frond juice as an alternative novel fermentation feedstock for value-added products. *Journal of Bioscience Technology* 110, 566-571.
- Ministry of Food and Agriculture (MOFA). (2011a). Agriculture in Ghana: Facts and Figures 2010. Retrieved from <http://mofa.gov.gh/site/wp-content/uploads/2011/10/AGRICULTURE-IN-GHANA-FF-2010.pdf>
- Ministry of Food and Agriculture (MOFA). (2011b). Program for perennial crops in Ghana: Brief on the oil palm sector in Ghana. Retrieved December 20, 2013 from http://www.mofa.gov.gh/site/?page_id=8819
- National Academy of Agricultural Sciences. (2002). Agriculture-Industry interface: Value added farm products. India, Policy paper 16.
- Ndidi, N., Arona, D., Kwadzokpo, F., & Aziz, E. (2013). The role of the private sector and the engagement of smallholder farmers in food value chains: initiatives and successful cases from Nigeria, Senegal, and Ghana. In Aziz, E. (Eds.), in *Rebuilding West Africa's food potential: Policies and market incentives for smallholder-inclusive food value chains*. Rome, FAO.
- Ngore, P. M. (2010). Evaluation of factors influencing value addition by butchery agricbusiness in Igembe North District. Master's thesis, Egerton University, Kenya.
- Ngore, P.M, Mshenga, G.O & Mutai, B.K. (2011). Socioeconomic factors influencing meat value addition by rural agribusinesses in Kenya. *Current Research Journal of Social Sciences*, 3 (6), 453-464
- Ntsiful, A. K. (2010). Outgrower oil palm plantations scheme by private companies and poverty reduction in Ghana. Phd thesis, St. Clements Univeristy, Turks and Caicos Islands Retrieved November 03, 2013 from <http://www.stclement.edu/grad/gradntsi.pdf>
- Nyanteng, V.K & Dzah, F. (2013). National analytical report: Population and housing census. Ghana Statistical Service Retrieved May 25, 2015 from http://www.statsghana.gov.gh/docfiles/2010phc/National_Analytical_Report.pdf
- Ofosu-Budu, K., & Sarpong, D. B. (2013). Oil palm industry in Africa: A value chain and smallholder's study for Ghana. In Aziz, E. (Eds.), In *Rebuilding West Africa's food potential: Policies and market incentives for smallholder-inclusive food value chains*. Rome, FAO.
- Osei-Amponsah, C. (2013). Improving the quality of crude palm oil: Transdisciplinary research on artisanal processing in Kwaebibirem District, Ghana. PhD thesis, Wageningen School of Social Sciences. Retrieved 23 November 2013 from <http://www.edopot.wur.nl/283402>

- Osei-Amponsah, C., Visser, L., Adjei-Nsiah, S., Struik, P. C., Sakyi-Dawson, O., & Stomph, T. J. (2012). Processing practices of small-scale palm oil producers in the Kwaebibirem District, Ghana: A diagnostic study. *NJAS- Wageningen Journal of Life Sciences* 6 (60/63), 49-56.
- Owusu, A. S. M. (2007). Living on the fast lane on an empty stomach? Eric Sakyi Nketiah (ed) Oil palm commodification and its implications on food security in Ghana (1807-2007). In E. S. Nketiah (Eds.), *Distance forum 'A multidisciplinary book of scholarly articles'* volume 1.
- Palmliden, F. (2014). Understanding and using correlation analysis. Retrieved January 10, 2014 from <http://www.tradestation.com/education/labs/analysis-concepts/understanding-and-correlation-analysis>
- Payne, R. K. (2005). Framework for understanding poverty. Highlands, Tex: AHA Process.
- Poku, K. (2002). Small-scale palm oil processing in Africa. Food and Agricultural Services Bulletin 148.
- Rahko, J. (2012). Potato value chain in Tanzania. Master's thesis, University of Helsinki.
- Sahn, D. E., & Younger, S. (2009). Living standards in Africa, poverty. Initiative for policy dialogue working paper series.
- Sauzet, M. (2009). Value addition through IP in technological innovations, design and branding in the agri-foods value chain. Retrieved June 13, 2013 from http://www.wipo.int/edocs/mdocs/sme/en/wipo_smes_dar_09/wipo_smes_dar_09_topic_03
- Scholz, k. (2010). Governance and upgrading in high-value chains of non-timber forest products: The case of shea in Ghana. Diploma-thesis in human geography, Goethe University, Frankfurt.
- Sporleder, T. (1992). Managerial economics of vertically coordinated agricultural firms. *American Journal of Agricultural Economics* 74(5).
- Sturgeon, T. J. (2008). From commodity chains to value chains: Interdisciplinary theory building in an age of globalization. MIT-IPC-08-001.
- Tagoe, S. M. A., Dickinson, M. J., & Apetorgbor, M. M. (2012). Factors influencing quality of palm oil produced at the cottage industry level in Ghana. *International Food Research Journal* 19(1), 271-278.
- Tanle, A., Ilechie, A. A., Awusabo-Asare, K., Ovenseri, G. O., & Anderson, M. (2011). Ocular conditions among women involved in palm kernel oil processing in the Cape Coast Metropolis, Ghana. *Society, Biology, Human and Affairs Journal*. 76(2), 25-40.
- Teye, J. K. (2012). Benefits, challenges, and dynamics of positionalities Associated with Mixed Method Research in Developing countries: Evidence from Ghana. *Journal of Mixed Methods Research, London, SAGE publications*. 20(10), 1-13.

- Trondstad, R. (1999). "Why value added agriculture?" Retrieved 25 May, 2013 from <http://ag.arizona.edu/arec/va/whyvalueadded.html>.
- Tubene, S. L. (2002). Developing a sound value-added enterprise for small farmers. Retrieved 25 May, 2013 from https://www.agnr.umd.edu/Extension/.../smallFarms/files/value_added.pd..
- United State Department of Agriculture (USDA). (2002). A national information for value-added agriculture. Retrieved 20 November, 2013 from http://www.agmrc.org/business_development/getting_prepared/valueadded_agriculture/waht-is-value-added-agriculture/
- Verheye, W. (2002). Growth and production of oil palm. *Soil, plant growth and Crop production Journal* 2, 1-10.
- Von Thunen, J. H. (1826). *Der Isoliertestaat in Beziehung auf Landwirtschaft und Nationalokonomie*, Hamburg (English trans. C.M Wartenburg (1966) *Von Thunen's Isolated State*, ed. P. Hall, Pergamon, Oxford).
- Webber, C. M., & Labaste, P. (2010). Building competitiveness in Africa's Agriculture. A guide to value chains concepts and applications. Washington D.C.:The World Bank.
- Wivstad, M. (2013). Research agenda for organic agriculture. Published by EPOK-Center for Organic Food and Farming, Swedish University of Agriculture.
- World Bank. (2001). Overcoming rural poverty. A World Bank country study, Washington D.C: The World Bank.
- World Bank. (2006). Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Washington D.C: The World Bank.
- World Bank. (2008). World development report 2008. Agriculture for development, overview. Washington D.C: The World Bank.
- World Bank. (2010). The state of the poor: Where are the poor and where are they poorest? Washington D.C: The World Bank.
- World Bank. (2012). "World Bank sees progress against extreme poverty, But flags vulnerabilities". Washington D.C: The World Bank.
- Zimmerman, E.W. (1951). *World resources and industries: A functional appraisal pf the availability of agricultural and industrial resources*. New York, Harper and Brothers.

APPENDICES

APPENDIX 1: QUESTIONNAIRE FOR SMALL SCALE PROCESSORS

This survey is undertaken by a Master of Philosophy student at University of Ghana. The underlying questionnaire for the study has been design to provide relevant data on value addition, particularly, its implication for socio-economic development in the oil palm industry in Ghana. Information collected will be treated with strict confidence and will be analysed for academic purposes only.

1. Questionnaire number.....
2. Date of interview
3. Location of the mill 0= Kusi 1= Kade 2= Subi 3= Kwae 4= Asuom

SECTION A: SOCIO ECONOMIC/ HOUSEHOLD CHARACTERISTICS

4. Respondent's sex. 0= Male 1= Female
5. Age of respondent 0= 15- 30 1= 30-40 2= 40-50 3= 50-60 4= 61+
6. What is your level of education? 0=primary 1= Junior high school 2=Senior high school 3= Tertiary 4= Non formal
7. Marital status 0= Married 1= Single 2=widowed
8. Households size 0= 1-5 2= 5-10 3= 10+

SECTION B: CHAIN ACTORS ROLE AND WORK

9. What is your main source of livelihood? 0= Oil palm Farming, palm and kernel processing 1= oil palm farming and palm oil processing 2= Palm oil and kernel processing 3= Palm oil processing 4= Processing and trading in palm oil 5= Processing of palm oil soap making
10. If you are a farmer, how many hectares of land do you cultivate under the oil palm? 0= less than 1 acre 1= 2- 3acre 2= 4-5h acre 3= 6-9 acre 4= 10 acre and above
11. What do you do with the harvested fruit? 0 = Sell directly to market women 1= Sell to palm oil processors 2= Process the fruit into palm oil 3= All of the above

12. What type of palm fruit/kernel do you process into oil? 0= Tenera 1= Dura 2= Any variety
13. How long have you been involved in this activity? 0= < 5 years 1= 5-10years 2= 11-15years 3=16-20years 4= 20 years+
14. Where do you get your main raw material? 0= Own farm 1= Private farm 2= Private farm and OPRI 3= OPRI and Private farm 4= OPRI, own farm and private farm 5= Own farm and private farms
15. What are the activities involve in the production of palm/kernel oil? State the cost of each activity.
16. How many people do you employ to help in processing 1 tonne of palm fruits/kernel (specify according to gender)?
.....
17. What is the number of household members engaged in processing activities?
.....
18. What type of processing activity are they engaged in?
19. What type of equipment do you use in your processing activity? 0= hand press and digester 1= Hydraulic hand press and digester 2= Digester screw press 3= combine nut cracker and shell separator 4= Digester 5= Others
20. How many tonnes of fruit bunches do you process per month in the lean season?and bumper season?

SECTION C: VALUE ADDITION (VA)

21. What type of palm/kernel oil do you produce? 0= dzomi1= Ngo paa 2= Saminango 3= Kernel oil4= others (specify)
22. Why do you process this type(s) of oil?
23. How much do you sell one gallon of the variety specified above? for lean season and For the peak season
24. What other value added product do you process/generate apart from the variety of oil mentioned above?
25. What is the value of each product listed above?

SECTION D: VALUE ADDED MARKETING/TRADE RELATIONSHIP

26. Who are your buyers? 0= Exporters 1= Local traders 2= Institutions 3= Food vendors 4= Others 5= All of the above
27. Where do you sell your products? 0= Local market 1= Mill 2= Home delivery 3= all of the above
28. What quantity of oil do you sell a month in a lean season?
29. (b) bumper season?.....
30. On what basis do you sell your products? 0= Cash 1= Credit 2= Advance payment 3= Contract marketing 4= Others (specify).....
31. What factors contribute to successful marketing of your products? Rank in order of importance (Regional branding, direct/niche marketing, road side marketing, product differentiation/diversification, and quality)
32. Are there unified scales and standards for measuring the amount of palm/kernel among trading partners? 0= Yes 1= No
33. What are the scales available for measuring your products? 0= 22.5 liter 1= 62.5 liter 2= 250 liter 3= Others

SECTION E: CONTRIBUTION TO SOCIO-ECONOMIC DEVELOPMENT

34. What are the benefits derived from processing palm fruit/kernel?
35. How do you use income from oil palm activity to meet household needs? 0= Food for household food supply 1= Health care for household member 2= School supplies 3= Rent and utilities 4= Paying back loan 5= Fulfilling Religious or ceremonial duties 6= Buying productive household assets 7= Others (specify)
36. Mention other businesses that are connected to the oil palm industry?

SECTION F: POLICY SUGGESTION

37. What are the challenges confronting farmer/processors in the oil palm industry?
38. How can the challenges in the oil palm industry be solved by Individual
39. Cooperative
40. Government/district assembly

APPENDIX 2: INTERVIEW GUIDES FOR KEY INFORMANTS

Interviewer:

Date/Time: Location:

Profession (since): Institution:

Value addition activities

- Support services offered to agro-industries in the district (Financial support, business advisory service, business creation, technology supply and technology transfer, and apprenticeship training, price formation, marketing and distribution).
- Access to the services provided.
- Effectiveness of support services in the district (successful outreaches, training, mission fulfilment, agro-processor satisfaction and so on).

Contribution of value addition in the oil palm industry to socio-economic development

- Connection to other activities and industries in the district.
- Contribution to income enhancement.
- Contribution to employment.
- Suggest methods by which agro-industries can increase profit in the district.

Policy on value addition in the oil palm industry/agriculture

- Opinion or perception on policy value addition in agriculture/ agro-industrialisation.
- How much has been achieved (supply of agro-chemicals, training, agro processing etc).
- Inadequacies in the policy support for value addition.
- Suggestions on what needs to be included in the policy.

APPENDIX 3: INTERVIEW GUIDE FOR CHAIN ACTORS IN THE OIL PALM INDUSTRY (OPRI, GOPDC, FARMERS, TRADERS, AND PROCESSORS)

Interviewer:

Date/Time: Location:

Profession (since): Function/Position:

Value addition activities

- ❖ Chain of activities in the farm/establishment/mill
- ❖ Importance of each activity
- ❖ Source of raw materials (seeds, seedlings, fresh fruits, palm and kernel oil etc.).
- ❖ Price determinants and negotiations (time of selling and other dependencies)
- ❖ Sales outlets and final markets of your product
- ❖ Market strategies for selling your products
- ❖ Cost of the activities above
- ❖ Price of each type of product

Contribution to socioeconomic development

- ❖ Connection to other parties or other sectors
- ❖ Contribution to employment
- ❖ Contribution to income generation

Policy implication

- ❖ Suggest ways of improving upon income generation and employment creation by individuals, cooperatives and local government in the industry.

APPENDIX 4: IFAD formula for sample size determination

$$n = \frac{t^2 \times p(1-p)}{m^2} \dots \dots \dots \text{Equation (1)}$$

Description of variables in the formula

n= required sample size

t = confidence level at 95% (standard value of 1.96)

p = estimated proportion of the study population with similar characteristics

m = margin of error at 5% (standard value of 0.05)

With the proportion of the small scale oil palm processors with similar characteristics (p) set at 90 percent which is equivalent to 0.90 the sample size for the study was calculated as follows:

$$n = \frac{1.96^2 \times 0.90(1-0.90)}{0.05^2} \dots \dots \dots \text{Equation (2)}$$

$$n = \frac{3.8416 \times 9}{0.0025} \dots \dots \dots \text{Equation (3)}$$

$$n = 138$$

APPENDIX 5: Measurement of value addition

Thus, the value derived = Net profit of value added processed fresh fruit bunch (FFB) - Net profit of non-value added processed fresh fruit bunch. Equation (4)

The Net profit = Gross Margin (GM) – Total Cost (TFC) Equation (5)

GM= TR-TVC Equation (6),

Where TR = Total Revenue, TVC = Total Variable Cost

The viability of value added activity was tested with the Benefit-Cost Ratio. Where the calculated ratio above 1 is regarded as positive and below 1, it is regarded as a negative.

Benefit-Cost Ratio = $\frac{\text{Present Value of Total Profit (Total Revenue)}}{\text{Present Value of Total Cost (Total Cost)}}$ Equation (7)

APPENDIX 6: Population correlation between two coefficients

$$\rho_{X,Y} = \text{corr}(X, Y) = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y} = \frac{E[(X - \mu_X)(Y - \mu_Y)]}{\sigma_X \sigma_Y},$$

.....Equation (8)

APPENDIX 7: Equation for calculating pearson correlation of coefficient

$$r_{xy} = \frac{\sum x_i y_i - n \bar{x} \bar{y}}{(n-1) s_x s_y} = \frac{n \sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n \sum x_i^2 - (\sum x_i)^2} \sqrt{n \sum y_i^2 - (\sum y_i)^2}}.$$

.....Equation (9)

APPENDIX 8: Equation for calculating hypothesis used for Testing correlation

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0 \text{Equation 10}$$

APPENDIX 9: Formula for computing the appropriate t value to test significance of a correlation coefficient

$$t^* = r \sqrt{\frac{n-2}{1-r^2}} \sim t_{\alpha, n-2} \dots\dots\dots \text{Equation 11}$$

Where " r " is the correlation coefficient (ρ) and " α " is the given level of significance. The degrees of freedom for entering the distribution is $n - 2$.

$$t^* = r \sqrt{\frac{n-2}{1-r^2}} \sim t_{\alpha, n-2} \dots\dots\dots \text{Equation (12)}$$

The criteria for making a decision on the significance of the correlation coefficient is to reject the null hypothesis when the test statistic (t^*) is greater than or equal to the t-table value ($t_{\alpha, n-2}$) and to fail to reject it if otherwise. The significance probability (p-value) can as well be used to make valid conclusions on the hypotheses above. In this case, the criteria are to reject the null hypothesis (H_0) if P-Value ≤ 0.05 and to fail to reject H_0 if otherwise. Let me be quick to add that, all the conclusions made on the hypotheses in this work have been based on the p-value of the outputs obtained with the SPSS.

APPENDIX 10: Equation for the anova procedure

The Hypothesis that was tested here was in the form:

H_0 : the population means of all groups under consideration are equal

H_1 : the population mean for at least one group is different .

The test statistics implored under the F-test is $F^* = \frac{SSR/k-1}{SSE/(n-k)} = \frac{MSR}{MSE} \sim F_{\alpha, k-1, n-k}$

.....Equation (13)

The test statistics can be calculated as follows:

Notations:

k = the number of levels of the variable

n_i = the sample size of i th level of the variable

x_{ij} = the j th response sampled from the i th level of the variable.

$\bar{x}_i = \frac{1}{n} \sum_{j=1}^{n_i} x_{ij}$, the sample mean of responses from the i th level/group

$SST = \sum_{i=1}^k \sum_{j=1}^{n_i} (x_{ij} - \bar{x})^2$ is the Total sum of squares. This measures the total variability in the data around the overall mean.

$SSB = \sum_{i=1}^k n_i (\bar{x}_i - \bar{x})^2$ is the sum of squares between groups.

SSB measures the total variation of the group means around the overall mean.

$SSE = \sum_{i=1}^k \sum_{j=1}^{n_i} (x_{ij} - \bar{x}_i)^2$ is the sum of squares within groups

APPENDIX 11: Anova Table

Source	Sum of S squares	df	Mean Square
F^*	<i>sig.</i>		
Between Groups	SSR	k-1	$MSR = \frac{SSR}{k-1}$
	$\frac{MSR}{MSE}$ <i>p-value</i>		
Within Groups	SSE	n-k	$MSE = \frac{SSE}{n-k}$
Total	SST	n-1	

Appendix 12: Descriptive Statistics of Incomes According To Factor Of Production

	Factors No.	Mean	Std. Deviation	Std. Error
TYPE OF FRUIT				
Tenera	15	614.73	71.174	18.377
Dura	10	640.84	69.113	21.855
Any type of fruit	55	608.73	85.127	11.478
TYPE OF PALM OIL				
Dzomi	27	626.20	89.680	18.377
Ngo pa	18	562.00	51.166	12.060
Saminango	15	574.40	51.651	13.336
Dzomi and Ngo pa	20	673.50	63.238	14.141
LEVEL OF EDUCATION				
Primary school	14	594.64	111.126	29.700
Junior high school	33	620.98	77.074	13.417
Senior high school	14	619.93	68.111	18.204
Tertiary	4	583.00	115.779	15.627
Non formal	15	618.73	60.524	15.627

Appendix 13: Anova Test For Relationship Between Income And Other Variables

ANOVA TABLE

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	<i>p-value</i>
TYPE OF FRUIT					
Between Groups	8739.609	2	4369.805	.666	0.517
Within Groups	505222.946	77	6561.337		
Total	513962.555	79			
TYPE OF PALM OIL					
Between Groups	147016.676	3	49005.559	10.150	0.000
Within Groups	366945.880	76	4828.235		
Total	513962.555	79			
LEVEL OF EDUCATION					
Between Groups	11525.130	4	2881.283	0.430	0.786
Within Groups	502437.425	75	6699.166		
Total	513962.555	79			

Appendix 14: Test For Anova Test For Relationship Between Income On Years Of Oil Processing In The Palm Kernel Industry**ANOVA TABLE**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	<i>p-value</i>
Regression	1077.909	1	1077.909	0.164	0.687
Residual	512884.646	78	6575.444		
Total	513962.556	79			

Appendix 15: Anova test for relationship between income and level of education**ANOVA TABLE**

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	<i>p-value</i>
Regression	667661.072	1	667661.072	6.253	0.019
Residual	2989568.395	28	106770.300		
Total	3657229.467	29			

Appendix 16: Descriptive Statistics Of Incomes According To Level Of Education

Level of Education	No.	Mean	Std. Deviation	Std. Error
Primary school	10	254.90	173.401	54.834
Junior high school	8	235.63	97.248	34.382
Senior high school	4	206.50	137.058	68.529
Non formal	8	544.25	622.312	220.020

Appendix 17: Anova Test of Relationship Between Income And Level Of Education**ANOVA TABLE**

Level of Education	Sum of Squares	Degrees of Freedom	Mean Square	F-ratio	<i>p-value</i>
Between Groups	553160.192	3	184386.731	1.544	0.227
Within Groups	3104069.275	26	119387.280		
Total	3657229.467	29			