UNIVERSITY OF CAPE COAST

# ECONOMIC ANALYSIS OF VALUE ADDED ACTIVITIES ALONG THE PINEAPPLE VALUE CHAIN IN SELECTED DISTRICTS IN THE CENTRAL REGION, GHANA

BY

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Thesis submitted to the Department of Agricultural Economics and Extension, School of Agriculture, College of Agriculture and Natural Sciences, University of Cape Coast, in partial fulfilment of the requirement for the award of Master of Philosophy Degree in Agricultural Economics.

MAY 2020

## DECLARATION

### Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere

Candidates Signature..... Date 21/05/2020

Name: Kwaku Boakye

### Supervisor's Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on the supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date 21-05-20

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## ABSTRACT

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. The study employed the descriptive survey design while interview schedules were used as the instruments to collect data from respondents. A sample size of 320, 66 and 169 pineapple farmers, processors and marketers was obtained. The study revealed that pineapple production and processing were profitable whereas marketing was not. The study rejected the null hypothesis that there was no significant difference in the profit share of the actors. Revenue, capital and planting materials were the determinants of farmer profit; capital, pineapple fruits and packaging materials were the predictors of the processors' profit and transportation, revenue and loading and off-loading cost predicts the profit of the marketer. The study found that pineapple farmers, processors and marketers were technically inefficient. In addition, the study revealed that the farmers were faced with the lack of credit facilities as a major constraint. For the processors, lack of raw materials was their major constraint whereas the marketers were faced with fruit perishability as their main problem. Furthermore, the activities by the pineapple farmers and marketers were highly sustainable while the activities of the processor was very highly sustainable. The study recommended among others that NGOs and other partner agencies promote the pineapple industry in various ways to assist decrease the country's poverty by providing the actors with credit facilities that will enhance their productivity, profitability, and sustainability.

## ACKNOWLEDGEMENTS

I am grateful and indebted to my supervisors Dr. William Ghartey and Dr. Samuel K. N. Dadzie for their patience, commitment, guidance and the valuable time they spent with me and reading through this work in spite of their tight schedules. To my mother and dad (Nana and Mrs. Asare Baffour II) your motivation, checks and financial support have brought me this far and my brother and sister. I am grateful. I owe much appreciation to Collins Boahen, James Afful, Nana Sarfo Aboagye, Emmanuel Annobil, Stephen Annobil, Loretta Kyei, Joseph Nyarko, Francis Padi Lamptey, Mr. Kankam and Mr. Gyimah for their support.

I would also like to acknowledge the continued encouragement I got from Mr. Emmanuel Inkoom, Prof. Festus Annor-Frempong and Prof. Henry Degraft-Acquah. I am also grateful to the Sarpong family of Nkoranza-Kyekyewere for their immense contribution towards the completion of this work.

I also want to extend my gratitude to the Directors and staff of the Department of Agriculture at the selected administrative assemblies in the Central Region for supporting me throughout my data collection. To the enumerators who helped me in the enumeration and data management, I say thank you so much. I also want show gratitude to all the pineapple farmers, processors and marketers who availed themselves to respond to the research instruments. I finally want to thank the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) for the support and training given to me.

## DEDICATION

To my mother Abena Amobea and my beloved Abigail Addobea

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ACRONYMS

| Acronym | Name |
|---|---|
| GDP | Gross Domestic Product |
| WDI | World Development Indicators |
| MoFA | Ministry of Food and Agriculture |
| NGOs | Non-Governmental Organications |
| DEA | Data Envelopment Analysis |
| SFA | Stochastic Frontier Analysis |
| SCM | Supply Chain Management |
| DMU | Decision Making Unit |
| GM | Gross Margin |
| NPV | Net Present Value |
| IRR | Internal Rate of Return |
| BCR | Benefit-Cost Ratio |
| RTS | Returns to Scale |
| CRS | Constant Returns to Scale |
| VRS | Variable Returns to Scale |
| OLS | Ordinary Least Squares |
| TRANSLOG | Transcendental Logarithmic Function |
| SPSS | Statistical Package for Social Sciences |

# CHAPTER ONE

# INTRODUCTION

## Background to the Study

The food and agricultural sector is an imperative part of the Ghanaian economy, due to its commitment towards growth and the reduction of poverty. The commitment of agriculture to development is through its commitment to Gross Domestic Product (GDP) and change in livelihood of most Ghanaians (Badu-Gyan, 2015). In terms of livelihood, the sector contributes largely towards meeting food needs, and provides employment opportunities and income to over 60% of the Ghanaian working population, especially in rural areas (Diao, Hazell & Thurlow, 2010; World Development Indicators [WDI], 2014). The contributions have led to the agriculture sector holding a central role in the developmental strategy of Ghana. Agricultural policies formulated since 2002 were intended to contribute to economic growth and development by improving access to market and financial services, improving infrastructure, enhancing human resources and institutional capacity, and reducing unsustainable management of land (MoFA, 2013).

In Ghana, small-scale subsistence farmers who contribute significantly to the economy drive the agricultural sector. The farming sectors' performance has been a wellspring of incredible worry to government. Most specialists in the nation concur that the poor performance of the agricultural segment comes from the utilisation of low-inputs innovations, high post-harvest misfortunes, lacking worth including advances that ineffectively interface production to request and little utilisation of market data by producers (Wolter, 2009). In other to reverse the current situation in the agricultural sector, farmers and entrepreneurs must

be provided with the incentives necessary to increase productivity and add-value to their commodities to increase their income and also gain better access to input and output markets through the development of appropriate linkage with the private sector service providers (Gereffi & Fernandez-Stark, 2016).

To do this, Porter's (1985) idea of value chain for industrial products is used in the context of small-scale agricultural production. The value chain idea can be described as a high-level model created to describe the process by which companies obtain raw materials, add value to the raw materials through multiple procedures to produce a finished product, and then sell the finished product to customers (Chyi Lee & Yang, 2000). Companies perform value-chain analysis by looking at each production step needed to produce a product and identifying methods to boost the chain's effectiveness. The general objective is to produce maximum value for the lowest total price possible and create a competitive advantage (Porter, 1985). The idea of value chain as a decision support instrument was introduced to the paradigm of competitive approaches created by Porter as early as 1979. In Porter's value chain, Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service are classified as main operations. Secondary activities include procurement, human resources management, technological development and infrastructure (Porter, 1985). The chain comprises a sequence of actors ranging from input merchants, producers, processors to final customers.

Pineapple (*Ananus comosus*) is a tropical fruit grown commercially globally as a high-value crop. Pineapple is indigenous to Central and South America and includes Cayenne, Queen, Sugarloaf, Pernambuco, Variegated, Baby, Red Spanish and the latest variety MD2 (Das, Das & Roy, 2016). In the

17th century or earlier, pineapple production was launched in Ghana. Samsam, a village in the Greater Accra region, was where pineapple was grown during this era and remained one of the country's major pineapple-producing regions (Pinto, 1990). This period was defined by fast agricultural growth through the Basel Missions and Governments. With time, however, pineapple production spread to other cities and villages within the Greater Accra region and ultimately to other areas of the nation with Ghana's Eastern, Central and Greater Accra areas being prominent in pineapple cultivation. There is very little, if any, cultivation in the Northern, Upper East and Upper West areas. It has a very large food content because it includes vitamins A, B, C, and minerals such as calcium, potassium, magnesium and iron. It is also a useful source of enzyme, bromelain (Das et al., 2016).

The fruit is eaten in both fresh and processed forms. A big amount of value-added products such as, jam, jelly blended jam and juice can be generated from it, which will provide the farming community with remunerative rates and create jobs for rural individuals. Smallholder pineapple farmers in Ghana grow between 1 and 10 acres of land, mostly without irrigation, hence extremely dependent on rainfall (MoFA, 2013). Pineapple can be spread from multiple vegetative components such as suckers, slips and crowns. It is generally propagated in Ghana from the suckers and harvest occurs between 16-18 months after planting (Williams, Crespo, Atkinson, & Essegbey, 2017).

There is a major increase in the export of fresh pineapple fruits and processed pineapple products, because of this, pineapple is regarded as Ghana's most important non-traditional horticultural export product. Pineapple exports contribute around 24 percent of the total horticultural exports (GEPC, 2012).

Pineapple exports from Ghana increased from 15.319 tons in 2004 to 46.319 tons in 2012 contributing over 80 percent on average to foreign exchange earned from the exports of horticultural products.

**Statement of the Problem**

The Ministry of Food and Agriculture in the year 2000 identified some agricultural products for development. Some of the agricultural products such as cashew, mango and pineapple were identified and have since gained prominence among peasant farmers (Abbey, 2005). But over the years, there has been the production of low-quality pineapple for both the local and the international market. Although measures such as improved agricultural extension services, provision of high quality planting materials, provision of agro-inputs for farmers, provision of good irrigation systems, ready market for farm produce, good agronomic practices and better access to market information have been put forth by the government and NGOs to improve the quality of pineapples produced for both local and the international market but the sector still find itself in the midst of crises.

Ghana's pineapple industry is now in the midst of an unprecedented crises after the intervention by the government to improve the quality of pineapple produced. These problems are either crop related or institutional related which include high cost of production and diseased planting material. Pineapple farmers are also faced with the problem of the depreciation of the cedi. This has led to increases in domestic prices of inputs, which are all imported (Yeboah, Afoakwah, Nwaefuna, Verner & Boampong, 2016). Furthermore, another challenge facing the industry is that pineapple farmers and marketers require flexibility in the frequent modifications in the type of

pineapple fruits required, while local pineapple producers are often unable to change quickly from one variety to another. They are also restricted by absence of reliable market, pest and disease occurrence, absence of storage equipment among others.

In spite of these problems associated with the pineapple industry, the industry offers a lot of opportunities to individuals as well as to the nation. Thus, pineapple production provides citizens with food and as well helps improve food security of the nation. Pineapple production also provides employment, increase the foreign exchange earnings of the nation. It also enhances growth by contributing to the sectors' GDP.

With all these benefits, many of the researches (Das et al., 2016; De La, Medina, & García, 2005 and Badar, 2014) that have been conducted in the field of pineapple value chain have been centered only on the issues and problems associated with the farming, harvesting, marketing and processing of pineapple with the aim of helping to increase yield and profitability of the farmers without actually looking at the activities that adds value to the product along the chain. It is on this premise that the current study sought to empirically assess the major value added activities along the pineapple value chain.

**Purpose of the Study**

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. The study specifically sought to;

1 examine the profitability of major value added activities along the pineapple value chain.

2. compare the efficiency (technical and scale) of the major actors along the pineapple value chain in the study area.
3. examine the constraints of the activities of the major actors along the pineapple value chain in the study area.
4. assess the sustainability of the major activities along the pineapple value chain in the study area.

**Research Questions and Hypothesis**

**Research Questions**

The study was guided by the following research questions.

1. What is the profitability of the major value added activities along the pineapple value chain in the Central Region?
2. How efficient are the activities by the major actors along the pineapple value chain in the Central Region?
3. What are the constraints of the activities of the major actors along the pineapple value chain in the study area?
4. How sustainable are the activities along the pineapple value chain in the study area?

**Research Hypothesis**

The study also tested the following hypothesis;

1. $H_0$: There is no difference in the share of profit among the major actors along the pineapple value chain.
2. $H_0$: There exist no difference in the efficiencies of the major actors along the pineapple value chain.

## Significance of the Study

The pineapple sector has the ability to grow, and so are its shareholders who are also going to earn a lot. The Central Region is ahead of its neighboring regions in the nation in relation to both relative and competitive advantage. The justifications for the study are as follows;

The finding from the study offered guidance for prospective investors on the level of attractiveness of the pineapple industry. Prospective investors or farmers who intend to go into pineapple production know how lucrative the enterprise is for them to make a good choice as to whether or not to venture into the pineapple industry. The study gave an understanding of the evolving opportunities and constraints in pineapple production. Understanding of these opportunities is also good for better decision making as far as pineapple production is concerned.

The findings allowed for the demonstration of ideals in sustainable development that could be applied in practice in the development of integrated value chain management framework for sustainable project impact. Further, findings provided a set of conceptual framework that have contributed to the planning and implementation of development programmes for smallholder pineapple production in Ghana.

The study sought to provide information for further research. It therefore provided the basis for further extensive research to be carried out in pineapple production. The research also added onto the body of knowledge that already exist.

## Delimitations

The population of this study was smallholder pineapple farmers who have registered with the Department of Agriculture in the respective districts, processors marketers of pineapple who have registered with the district environment unit in the selected districts. The Central Region was chosen because of time and resource constraint faced by the researcher. The study focused on the producer-marketer (Production-Processing-Marketing) interface of the pineapple value chain in Central Region. The study also included post-processing activities (wholesaling and retailing) profits and expenses that accrue to chain actors and institutions that are critical to chaining the conduct of dynamics and actors in the chain. The study was limited to the value-added activities along the value chain of pineapples. Interview schedule was the primary tool used for the study, interview schedules were used because it had a greater response rate and also helped to obtain data from the participants as most of them were unable to read and write. The study was further limited to the use of descriptive statistics such as means, standard deviations, frequencies and percentages. Furthermore, the research was limited to the use of Data Envelopment Analysis (DEA) to determine the efficiency (technical and scale) of the main actors along the chain. The analysis of the Gross margin and the profit function were used to determine the profitability of the actors ' activities. All the results from the study findings were tested at 0.05 significance level.

## Definition of Terms

**Value addition:** Value-addition refers to cases where a company takes a product that can be deemed a homogeneous product, with few

distinctions (if any) from that of a rival, and offers a function or add-on to prospective clients that gives it a higher sense of value.

**Value chain:** The process or operations through which a business adds value to an item, including manufacturing, marketing, and after-sales service provision.

**Smallholder farmer:** Are those farmers who own small-scale land plots on which they grow subsistence crops and one or two cash crops that rely almost solely on family labour.

**Supply chain management:** Supply chain management (SCM) refers to managing the flow of goods and services, involves moving and storing raw materials, inventory of work-in-process, and finished goods from point of origin to point of consumption.

**Product flow:** This is seen as a unified scheme of interdependent organisations where intermediaries work together to create value as products continue to the customer through the channel.

**Market chain:** The supply chain defines all participants engaged in a financial activity using inputs and services to facilitate the manufacture and delivery of a product to the final consumer.

**Marketer:** One dealing in a market, specifically one promoting or selling a product or service

**Organisation of the Study**

This study was structured in five chapters. Chapter One comprised the background of the study, the statement of the problem, the purpose of the study, the research questions, the research hypothesis, the significance of the study, the delimitations, the definition of terms and the organisation of the study.

Chapter Two of the study concentrated on literature review with more light on research results produced by other writers relevant to the problem under study. Chapter Three examined the research methods used for the study. It involves research design, sampling procedures, population, data collection instrument and data collection and analysis techniques. The results and the discussion of the findings were discussed in the fourth chapter. The final chapter includes the summary, conclusion s and recommendations based on the research outcomes. Suggestions for further research were also addressed.

# CHAPTER TWO

# LITERATURE REVIEW

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. Accordingly, this section reviewed related literature. According to Becker, Bryman and Ferguson (2012), literature review helps the researcher to know what is already known about the field of interest so the wheel is not reinvented. It must be noted that scientific journals, books, conference and seminar papers, and other reliable web-based resources were consulted for this purpose.

## Origin of the Value Chain Concept

A value chain is an arrangement of exercises performed by a company operating in a specific sector, bearing in mind the end objective of conveying an important item or market administration (Porter, 1985). The concept emerges through business organisation and was first exemplified by Michael Porter in his accomplishment of 1985, *Competitive Advantage: Creating and Sustaining Superior Performance*.

The probability of the value chain relies on the company's technical view, seeing an assembly (or administration) company as a structure consisting of subsystems each with inputs, change processes and returns. Information sources, alter processes, and returns include money acquisition and use of resources, work, equipment, hardware, buildings, property, organisation, and administration. How value chain exercises are finished determines costs and affects paybacks (Gurría, 2012).

The notion of value chains as decision support instruments was introduced to the paradigm of competitive approaches created by Porter as soon

as 1979 (Porter, 1979). In Porter's value chains, the main operations are Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service. Secondary activities include procurement, human resources management, technological development and infrastructure (Porter 1985).

According to the OECD Secretary-General (Gurría, 2012), the advent of worldwide value chains (WVCs) in the late 1990s supplied a catalyst for rapid change in the international investment and trade landscape, with significant, far-reaching implications for both governments and businesses (Gurría, 2012).

The value chain categorizes an organization's generic value-adding operations. The activities regarded under this product / service improvement method can be widely classified under two main activity sets.

1. Physical / traditional value chain: a physical-world activity conducted to improve a product or service. Such actions developed over time as a result of the knowledge individuals acquired from their company behaviour. As the willingness to gain greater profits drives any company, experts (trained / untrained) practice these to attain their objective.
2. Virtual value chain: The emergence of computer-based business-aided systems in the contemporary world has resulted to a totally fresh horizon of market space in contemporary business jargon – cyber-market space. Like any other computer application sector, we have also attempted to adopt the methods of our physical world to enhance this digital world. All activities of the physical value-chain enhancement process of the persistent physical world that we

implement in the cyber market are generally referred to as a virtual value chain.

Practically speaking, beginning in 2013, no vibrant company can bear to remain adhered to any of these chains of high regard. Keeping in mind the ultimate objective of covering both market spaces (physical world and digital world), companies need to send out their absolute best practices in both areas to generate the most helpful data that can also be used to improve advancing items / benefits or to build up some fresh item / benefit (LeBlanc, Matthews & Mellbye, 2013).

As a strong instrument for strategic planning assessment, the value chain framework rapidly made its way to the forefront of leadership thinking. A cross-functional method evolved over the next century, the simpler notion of value streams had some success in the early 1990s (Martin, 1995).

The notion of the value chain has been expanded beyond individual companies. It can apply to entire supply chains and networks of distribution. The delivery to the end client of a combination of products and services will mobilise various financial variables, each managing their own value chain. The industry's broad synchronised interactions of these local value chains generate an expanded, sometimes worldwide value chain. Porter refers to this bigger interconnected value chain scheme as the "value scheme". A value system involves the value chains of the distributor of a company (and its distributors all the way back), the company itself, the distribution channels of the company and the buyers of the company (and presumably extended to the buyers of their products, and so on).

The fresh strategy adopted by many managerial strategists is to capture the value produced along the chain. For instance, a company may need to locate its parts vendors near its assembly facility to minimise transportation costs. By exploiting the upstream and downstream data that flows along the value chain, companies may attempt to bypass intermediaries creating fresh business models or improve their value system in other respects.

Analysis of the value chain has also been used in large petrochemical plant maintenance organizations to show how job selection, job planning, work scheduling and finally job execution can help drive lean maintenance techniques (when considered chain elements). The Maintenance Value Chain approach is particularly efficient because when used as a tool to assist change management, it is deemed more user-friendly than other business process tools.

**Agricultural Value Chain**

Since the beginning of the millennium, the concept of agricultural value chain has been used, mainly by those working in the development of farming in developing countries. Despite the reality that there is no usually recognized significance of the word, it frequently relates to the entire merchandise range and ventures that are crucial for a rural product to move from the farm to the last customer or consumer. At the heart of the concept of the agricultural value chain is the possibility of mindful personalities connected with the production and transmission of products to clients by means of a movement agreement (Henriksen, Riisgaard, Ponte, Hartwich, & Kormawa, 2010). In any case, this "vertical" chain cannot operate in disconnection, and an essential aspect of the value chain strategy is that it also considers "standardized" impacts on the chain, such as info and fund agreement, augmentation bolster, and the overall situation

of empowerment. The strategy has been found useful, particularly by sponsors, in that it has given rise to a consideration of each of those factors influencing farmers ' ability to reach the business sector effectively, prompting a wider chain mediation scope. It is used to update current chains as well as to acknowledge the open platform for small farmers for sponsors (Hailu, 2012).

Donors and others who support agricultural growth, such as GIZ, DFID, ILO, IIED and UNIDO, have generated a variety of papers to help their employees and others in evaluating value chains so that they can decide on the most suitable measures to either update current chains or encourage fresh ones (Springer-Heinze, 2007). However, distinct organizations interpret the implementation of value chain analysis differently, with potential repercussions for their developmental effect. The proliferation of guides took place in a setting where important conceptual and methodological aspects of assessment and growth of the value chain are still developing (Donovan, Franzel, Cunha, Gyau, & Mithöfer, 2015). Many of these guides not only include comprehensive processes requiring professionals to conduct the evaluation, but also use comprehensive quasi-academic methodologies (Henriksen, et al., 2010). One such approach is to compare the same value chain over time to evaluate changes in rents, governance, structural effectiveness, and organisational structure (Prowse & Moyer-Lee, 2014).

**Principles Underlying the Value Chain Concept in Agriculture**

Essential underlying principles of value chain notion in agriculture are that agriculture markets and customers' requests decide the nature, structure and lead of current agri-business (Nang'ole, Mithöfer & Franzel, 2011). Changing global markets make new open doors from growing markets as well as make

extra business hazard for developing countries because of expanded rivalry in the domestics, local and additionally worldwide markets, therefore the need to enhance intensity of the agricultural sector of the developing countries through the value chain approach (Kaplinsky & Morris, 2001). The imperative stemming from the above observation is therefore obvious; a private-public stakeholders' engagement in a sustainable dialogue and to adopt innovative ways of building networks, doing business, providing services, establishing supportive administrative procedures government policies. These principles are:

i) The breakdown of the course of production (input supply to consumption) into chain links.

ii) Chain links are activities

iii) Value is added to each activity

iv) Overall input will be;

   a. Improved quality

   b. Improved quantities

   c. Reduced cost

v) Be able to stay in competitive world,

hence the following underlying assumption to support these principles.

**Assumption of the Value Chain Approach in Agriculture**

A number of assumptions have been put forward to underpin the value chain approach in agriculture and these according to the agribusiness value chain literature (Vermeulen, Woodhill, Proctor & Delnoye, 2008) include:

- Clearly stated policy statement indicating expected role of agriculture to the socio-economic development of the country.

- Understanding the gap between agricultural potential and actual performance
- Clear identification of the various value chains and market opportunities
- Certain actors or change agents are willing and able to motive others to follow
- All chain actors and facilitators understand and assume their roles with dedication and purpose
- Operators/actors act in their individual and collective interest and assume responsibility from the start
- All actors benefit from upgrading
- Both positive and negative experiences are taken as basis for progress
- Timely availability of critical information

**Characteristics of the Value Chain Approach in agriculture**

The value chain literature (Nang'ole et al., 2011 and Vermeulen et al., 2008) also identifies the following pertinent features of the value chain concept in agriculture stemming directly from the assumption and principles above.

- Production line consist of series of chains
- Each chain consists of activities
- Value added to an activity affects all other activities (link)
- Works when there is free and timely flow of information among the operators/actors
- Each of the operators of the activities monitors and evaluates along the chain
- All the operators benefit when value is added

- A sequence of production processes (also known as linkages) from the provision of specific inputs for production, transforming, marketing and the final consumption
- The quality of linkages and coordination between producers, processors, traders and distributors of a particular product development determine the success of the value chain.
- The performance of every single partner in the chain determines the strength of the entire value chain
- The weakest link in the chain also determines the competitiveness of the final product
- Certain actors or change agents are willing and able to motivate others to follow
- All chain actors are facilitators understand and assume their roles with dedication and purpose
- Operators/actors act in their individual and collective interest and assume responsibility from the start
- Both positive and negative experiences are taken as basis for progress

**Pineapple Value Chain**

Value Chain is a chain of activities performed by a company that works in a particular sector to offer a precious product or service to the market. Value chain strategy requires a complete knowledge of a market scheme: companies operating within a sector from input providers to end-market buyers; supportive markets providing the sector with technical, company and economic services; and the company climate in which the sector works. Therefore, the value chain of Pineapple relates to the chain of activities carried out in other to supply a

precious pineapple item to the market. The chain is made up of actors like input distributors, farmers, handlers, processors, traders and customers. The actors ' operations can be defined in Figure 1.

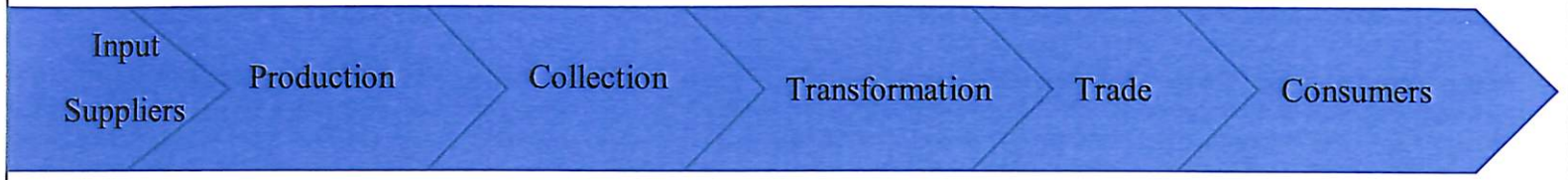
| | | | | | | |
|---|---|---|---|---|---|---|
| Value Chain |  | | | | | |
| Actors | Cooperatives and private input suppliers | Pineapple Farmers | Handlers | Processors | Exporters<br>Importers<br>Retailers | Consumers |
| Functions | Providing required supplies | Growing<br>Harvesting<br>Grading<br>Sorting | Gathering<br>Storing<br>Grading<br>Transporting<br>Waxing | Sorting<br>Mould prevention<br>Storing<br>Drying | Receiving<br>Quality control<br>Storing<br>Selling<br>Transporting<br>Drying | Consume |

*Figure 1:* Pineapple Value Chain Map

## THEORETICAL FRAMEWORK

Theories are developed to explain, predict and comprehend phenomena and, in many times, question and extend current understanding within the boundaries of critical boundary assumptions (Swanson & Chermack, 2013). The theoretical framework, according to Swanson and Chermack, is the structure that can maintain or promote a research study concept. The theoretical framework presents and describes the theory explaining why there is the research problem being studied. The theoretical framework reinforces the research as follows:

1. An explicit theoretical assumptions declaration allows the reader to critically assess them.
2. The theoretical framework connects the scientist to current understanding. You are provided a foundation for your hypotheses and the selection of research methods, guided by an appropriate theory.
3. Articulating a research study's theoretical assumptions forces you to tackle why and how. It allows you to move intellectually from simply describing a phenomenon that you have observed to generalizing on different elements of the phenomenon.
4. Having a theory enables you define those generalizations ' boundaries. A theoretical framework indicates which main variables affect an interesting phenomenon and highlights the need to examine how and under what conditions these main variables might vary.

Because of its application, good theory in the social sciences is of value precisely because it fulfils one primary purpose: to explain the meaning, nature and challenges associated with a phenomenon that is often experienced but

unexplained in the world we live in, so that we can use that knowledge and understanding to act in a more informed and effective manner (Swanson & Chermack, 2013).

**Supply Chain Management Theory**

Supply chain management is a literature stream that explores operations management in value chains. Supply chain management emerged in the logistics literature of the 1980s and focused initially on logistics planning and inventory optimization throughout the supply chain (Cooper, Lambert & Janus, 1997). Supply chain management is customer-oriented, i.e. customer demand leads in this strategy, and seeks to integrate business planning and balance supply and demand across the entire supply chain from original manufacturer to ultimate customer / consumer (Cooper et al., 1997). Information and communication systems are regarded as the backbone of supply chains that run smoothly.

The term value chain was first developed by Michael Porter (1985) in the 1970s and 1980s in conjunction with similar approaches such as the "filiere" approach (from French origin and the commodity chain concept that originated from the theory of world systems, Raikes, Friis, Jensen & Ponte 2000), reflecting the value-adding character of business processes within the company's borders. Both supply chain approaches and value chain approaches concentrate on primary processes, i.e. processes of conversion and transaction in and across vertically associated businesses. From the view of developing countries, SCM focuses on improving processes and quality and optimizing food distribution processes.

**Supply Chain Management and Supply networks**

In a competitive environment, not all management goals can be achieved fully by single businesses acting alone. As client requirements increase and become more, particular company's initiatives need to be undertaken to coordinate duties across the supply chain to enhance service and reduced expenses (Lambert & Cooper 2000). The issue is that typically distinct companies work under distinct philosophies of leadership and pursue divergent objectives. Successful relationships involve executives to reconsider how they operate business with suppliers and clients in order to achieve the advantages of integrated and concentrated supply chain policies (Lambert & Cooper 2000).

Supply Chain Management is the integration of important business processes from end users through initial suppliers that provide clients and other stakeholders with goods, services and knowledge that add value (Lambert & Cooper 2000). The incorporation of the word network into the studies on supply chain management can be seen as an effort to broaden the notion. Two separate streams of studies have influenced the emergence of supply network ideas, according to Lamming, Johnsen, Zheng and Harland (2000):

1. The Industrial Marketing and Purchasing Group's (IMP) mainly descriptive study on industrial networks.
2. In the fields of strategic management, operations management and logistics, the more prescriptive SCM research.

Supply networks can be described as supply chain sets, describing the flow of products and services from primary sources to end users, according to Lamming et al., (2000). The company network strategy assumes the systems are open and therefore the network is integrated in its setting and interacts with it.

Business-to-business entities are integrated in a complex network of interactions with providers, clients and a number of other stakeholders. Based on this company market view, Håkansson and Snehota (1995) developed a business network model in which a business network was defined as three interrelated networks of operations, actors and resources (ARA-model).

The starting point for the ARA-model is made up of conscious players performing a collection of activities depending on their resources. Actors are organizations, but there are other actors in networks as well. An activity happens when one or more actors use other resources to combine, develop, exchange or produce resources. Resources are all about the value of the actor and can be used to produce higher value for themselves and others. It can be technical, personal or capital resources of this kind. Resources are linked to both the actors and the tasks conducted. The actors are interconnected and there are exchanges that form connections, ties and bonds between actors by combining actors, operations and resources (Håkansson et al., 1995).

The network's structural dimensions are crucial, particularly when the supply chain is analysed and managed. Network supply chains look distinct from the view of each company. Each business considers itself as the focal business and manages it. Since each company is a part of the supply chain of the other, understanding their interrelated roles and views is essential. The reason for this is that only if each business can realize the significance of this integration and process management across business borders will the entire value chain be effective (Lambert & Cooper 2000).

Business-to-business firms are integrated in a complex network of interactions with suppliers, clients and a number of other stakeholders and thus

the network is integrated in its setting and interacts with it. A company's opportunities and constraints are linked to both the funds invested in the interactions and the inner capacities of the businesses. Relationships and resources of each company can be created and combined in many distinct ways with others. This generates significant innovation possibilities for both businesses to take advantage of them. However, a network change always includes changes in both businesses and relationships. This implies a business seeking change is always dependent on other people's permission and actions to attain the change. Nevertheless, a business can mobilize portion of the network in the direction it wants, if its action is properly designed and seen by those whose assistance it requires to be positive. There are few independent companies; they are component of an embedded supplier and customer system. Most businesses are chain intermediaries by receiving inputs and sending these inputs to produce customer's goods or services.

Managing and coordinating the supply chain has become increasingly crucial in latest years, as businesses need to minimize their expenses and maximize their business prospects (Lambert & Cooper 2000). Management of the supply chain is seen as an arena where companies can find possibilities to reduce costs. This theory is applicable to the study because it centres on cost savings. It also create value, satisfaction and loyalty for the client, resulting in enhanced profit margins and better profitability for the company.

**Innovations Theory of Profits**

This profit theory explains that because of successful innovations introduced by the entrepreneurs, economic profits arise. Schumpeter (2017) who has maintained that the primary role of the entrepreneur is to implement

economic innovations and revenues are reward for his performance of this function.

What is innovation now? Innovation has a very wide connotation, as Schumpeter used it. Any fresh measure or strategy taken by an entrepreneur to decrease its manufacturing costs or boost its product requirement is an innovation.

It is thus possible to divide innovations into two classifications. First kinds of innovation are those that decrease manufacturing costs. The introduction of a fresh equipment, new and cheaper technique or manufacturing process, exploitation of a fresh source of raw materials, a fresh and better method of organizing the company, etc. are included in this first form of innovation (Schumpeter, 2017). Second kinds of technologies are those that boost product demand. The introduction of a fresh product, a new range or product design, a fresh and superior advertising technique, discovery of new markets, etc. are included in this category (Sweezy, 2018). If an innovation proves to be effective, that is, if it achieves its objective of either lowering manufacturing costs or raising a product's demand, it will yield returns (Sweezy, 2018).

Profits arise because either cost drops below the prevailing product price owing to successful inventions or the entrepreneur can sell more at a better price than before. It is worth noting here that benefits from a specific development tend to compete with each other as others imitate and embrace it as well (Schumpeter, 2010). An innovation is no longer new or novel when it is also known and adopted by others (Schumpeter, 2010). When an entrepreneur introduces a fresh innovation, he first finds himself in a situation of monopoly

while the innovation is limited to him alone. If others also embrace it to get a share after some moment, earnings will vanish.

This theory applies to this study in the sense that the quest of any actor to add value to their products turns to increase the demand for the product and also reduce the cost of production when the innovation is introduced and hence an expected increase in profit at every stage along the pineapple value chain when value is added.

## ANALYTICAL FRAMEWORK

### Profitability Analysis

Profitability enables you to measure a company's ability to earn an adequate return on sales, total assets, and capital invented. Egyir (2007) shows that a venture's profitability can be evaluated using partial budgeting net profits, gross margin costing, and marginal return or payback period rates. For this work, the analysis of the gross margin and the profit function were used.

### Gross Margin Analysis

A gross margin is a company's gross income less the variable cost of achieving it. Variable costs are those directly attributable to a company that differs by the size of a company. The gross margin is not gross profit because it does not take overhead or fixed costs such as depreciation, interest payment rates, power, water, insurance or mortgage costs into account, Quinlan (2004). According to Quinlan (2004), assessment of the gross margin may be used in two respects;

- to diagnose the weaknesses of the existing farm business and
- to prescribe for reorganization of the farm business

Gross margin analysis is very important for comparing performance of farm enterprise. Quinlan (2004) further stated that if a farm enterprise records a relative low gross margin, it might be due to;

1. Unfavourable input costs relative to product prices.
2. Low output associated with low variable cost (pointing to inadequate expenditure on variable cost, example feed, fertilizer, labour, machine expenses).
3. Excessive inputs relative to value of production.
4. An antiquated, inadequate or otherwise unsuitable type of production technology.

**Efficiency Analysis**

We assume that a producer uses a nonnegative vector of N inputs, denoted $x = (x_1, \ldots, x_N) \in R_+^N$ to produce a nonnegative vector of M outputs. This output vector is denoted $y = (y_1, \ldots, y_M) \in R_+^M$. Thus, the technology set, or the collection of all feasible input and output vectors, is defined as:

$T = \{(y, x): x\ can\ produce\ y\} \in R_+^{M+N}$ ..... (2.1)

The following assumptions are made regarding the technology set:

1. $(0, x) \in T\ and\ (y, 0) \in T \Rightarrow y = 0.$
2. It is a closed set.
3. T is bounded for each $\in R_+^N$
4. $(y, x) \in T \Rightarrow (\lambda y, x) \in T for\ 0 \leq \lambda \leq 1$
5. $(y, x) \in T \Rightarrow (y, \lambda x) \in T\ for\ x \geq 1$
6. $(y, x) \in T \Rightarrow (y', x') \in T \forall (y', -x') \leq (y, -x)$
7. T is a convex set.

The first assumption states that producing nothing from a given set of inputs is possible, and that no output is possible without any input. The second assumption ensures the existence of technically efficient input and output vectors. The third property ensures that finite input cannot produce infinite output. Assumptions 4 and 5 are weak monotonicity (weak disposability) properties that ensure both radial contractions and radial expansions are possible. These two assumptions are often replaced by strong disposability property. Any increase of inputs and any decrease in output is not limited to only radial movement. The convexity assumption is not generally required, but if included commodities must be continuously divisible.

The production technology also can be represented using output or input sets. The technology defined by set T can be equivalently defined using the output set. For each input vector x, P(x) is defined as the set of feasible outputs. P(x) is expressed formally as,

$$P(x) = \{y: x\ can\ produce\ y\} = \{y: (y,x) \in T\} \in R_+^N \quad \ldots\ldots\ldots\ldots \quad (2.2)$$

The output sets P(x) are defined in terms of T, and since T is assumed to satisfy certain properties, it follows that P(x) can satisfy corresponding properties. Similar properties as T are assumed for P(x).

A third characterization of the technology can be defined by the input set, L(y). L(y) is represented as,

$$L(y) = \{x: x\ can\ produce\ y\} = \{y: (y,x) \in T\} \in R_+^M \quad \ldots\ldots\ldots\ldots \quad (2.3)$$

This input set consists of all input vectors x that can produce a given output vector, y. As with P(x), L(y) is assumed to satisfy similar properties corresponding to T.

This technique is relevant to the study because it allowed the researcher to estimate the efficiency (technical and scale) levels of the actors. It was through this the researcher have known those actors who were technically efficient and those who were inefficient.

**Production Frontiers**

The single-output case of the production technology is useful in illustrating a production function. The single-output specification can be used to describe a technology that only produces a single output, or the more likely event that multiple outputs are produced and then aggregated into a single composite output $y = g(y_1, \ldots, y_M)$. Definitions 2.2 and 2.3 can be used to obtain the following definition:

$f(x) max\{y: y \in P(x)\} = max\{y: x \in L(y)\}$ ..... (2.4)

Where x is a vector of sources of info and y is a scalar amount. The production frontier f(x) portrays the most extreme yield that can be produced with some random information vector, and as such, describes the upper limit of the possible output. Producers work at or beneath this limit. The measurement of the distance from the input-output combination of each producer to the production frontier characterizes the central problem in measuring technical efficiency. Two ways to deal with estimating this separation are remove capacities what is more, cost, income, and benefit outskirts.

Before moving on to the discussion of distance functions, it is important to mention the case where multiple-inputs are used to produce multiple-outputs. In this case a joint production frontier, or production possibilities frontier, is used to describe the upper boundary of feasible production. This frontier involves defining the efficient subset of both the input and output vectors in

which are at an un-scalable maximum and minimum, respectively. Joint production frontiers are only from time to time utilized in observational examination in light of the fact that the upper limit of the production function in the multiple-input and multiple-output case is all the more effortlessly gotten using the distance functions. An input distance function involves the scaling of the input vector to measure distance from the producer to the boundary of production possibilities. The input distance function can be defined based on the input set L(y) as follows:

$$D_1(x: y) = max\{p: x/p \in L(y)\} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2.5)$$

Since L(y) satisfies certain properties, the input distance function will satisfy a corresponding set of properties. The input distance function is illustrated in Figure 2 for two inputs, x1 and x2, that are used to produce one output, y.

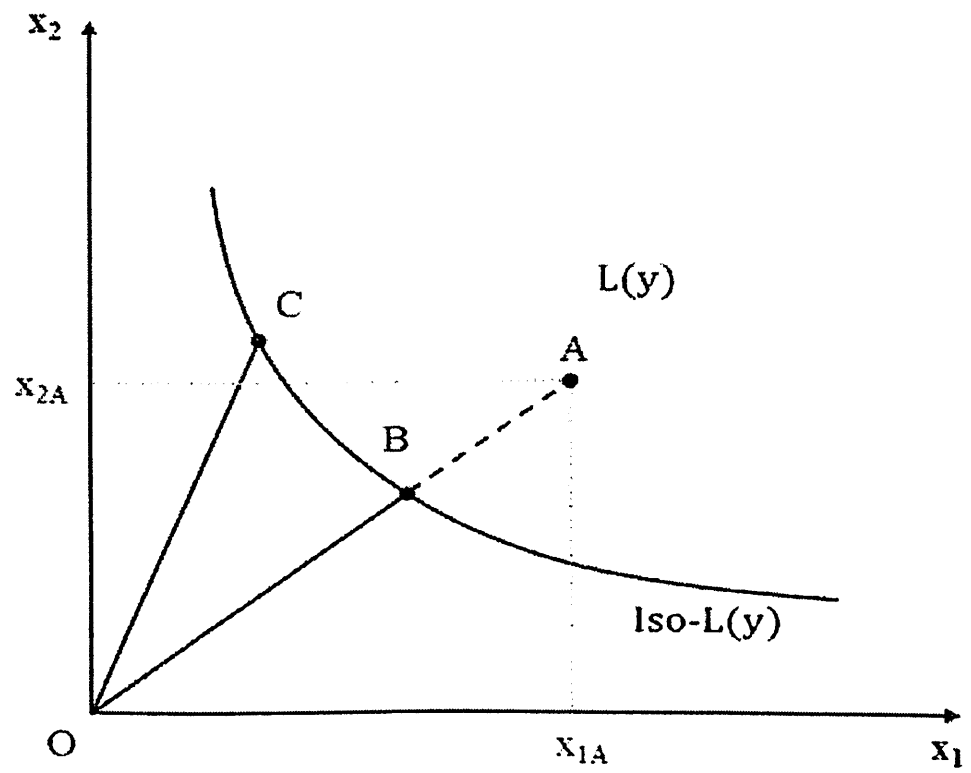



*Figure 2:* Input Distance Function. Adapted from Coelli, et al. (2005).

**Technical Efficiency**

Koopmans (1951) provided a definition of technical efficiency for a multiple-input and multiple-output case: A producer is technically efficient if an increase in any output is possible only by decreasing at least one other output or increasing at least one input. Conversely, a reduction in any input is possible only by reducing at least one output, or by increasing at least one other input. Based on this definition, a technically inefficient producer could improve efficiency by using less of at least one input to produce the same level of output, or could use the same inputs to produce more of at least one output.

Koopmans' definition of technical efficiency provides a way to differentiate between efficient and inefficient production states. It does not, however, provide a measure of the degree of inefficiency or the tools for comparison between inefficient and efficient vectors. Debreu (1951) presented a radial measure of technical efficiency that addressed these issues. Radial measures are convenient as they focus on the maximum feasible equiproportionate reduction of variable inputs, or the converse maximum feasible expansion of all outputs. Radial measures are also useful as they are independent of a unit of measurement. There is, however, one major drawback to using radial measures of efficiency. Technical efficiency as measured by radial contraction of the input vector or expansion of the output vector may understate the degree of inefficiency present given the technology due to slack in inputs or outputs. In other words, it fails to take into account the reallocation of one input for another. Thus, a producer may be efficient based on Debreu's measure, but can be inefficient based on the definition of Koopmans.

Farrell (1957) expanded on the work of Debreu by proposing that efficiency is made up of two components; technical efficiency and allocative, or price, efficiency. Technical efficiency refers to the producer being able to achieve maximum output from a given set of inputs. Allocative efficiency refers to the producer being able to select the appropriate proportion of inputs based on price of those inputs and the available technology. Note that implicit in the measure of allocative efficiency is a behavioural assumption. Farrell's work uses the assumption of cost minimization in a competitive market. The product of these two efficiency terms gives a measure of overall, or economic, efficiency.

**Methods of Efficiency Measurement**

Measurement of productive efficiency requires the empirical approximation of the true production frontier. Once the frontier has been estimated, the measurement of efficiency based on distance from the frontier is straight-forward. The challenge lies in estimating the frontier. Two major contrasting techniques have been frequently employed to estimate production frontiers; one based on mathematical programming and the other based on econometrics.

The econometric approach, typified by stochastic frontier analysis (SFA), seeks to estimate the production frontier, and to distinguish the effects of noise from inefficiency. This form requires the specification of a production function and estimation of the distributional form of the inefficiency term. In a simple multiple input and single output case, the functional relationship is given as $y_i = f(x_i, \beta) + e_i$, where $y_i$ is the scalar output of the producer, i is the producer being evaluated, and $\beta$ is a vector of parameters to be estimated. The residual $e_i$

is decomposed into a random error component $v_i$ and an inefficiency component $u_i$.

Data envelopment analysis (DEA) is a mathematical programming approach that seeks to define a piecewise linear, quasi-convex hull over the data. To be technically efficient, production must occur on the frontier. In the case of DEA, the frontier is defined by best practice based on comparison of observed producers. Each producer's inputs and outputs are weighted, and the program is solved to minimize the weighted input-output ratio subject to the constraint that all weights are non-negative and that one bound below the weighted sample. In this study, the mathematical programming technique (DEA) was used to estimate the efficiency of technical efficiency of the major actor along the pineapple value chain in both variable and constant returns to scale. The DEA was chosen because it allows for the relaxation of the constant returns assumption and give room for the estimation of both technical and scale efficiencies which the parametric alternative fails to do.

**Data Envelope Analysis (DEA)**

Data envelopment analysis (DEA) is a mathematical programming approach that seeks to define a piecewise linear, quasi-convex hull over the data. The first DEA model was presented by Charnes, Cooper and Rhodes, (1978) and is frequently referred to as the CCR model. This model takes an input orientation and assumes constant returns to scale. A variable returns to scale model referred to as the BCC model was popularized by Banker, Charnes & Cooper, (1984). DEA is popular among practitioners because it does not require the specification of a functional form for the production technology or make behavioural assumptions for the producer. In addition, if prices are known,

economic efficiency can be estimated and decomposed into its technical and allocative components. The basic DEA model is deterministic and can be specified as follows:

$$Max \sum_{k=1}^{s} v_k y_{kp} \Big/ \sum_{j=1}^{m} u_j x_{jp}$$

..... (2.6)

$$\sum_{k=1}^{s} v_k y_{ki} \Big/ \sum_{j=1}^{m} u_j x_{ji} \leq 1 \forall_i$$

Where:

K=1 to s, j=1 to m, i=1 to m

$y_{ki}$ = Amount of output K produced by DMU I, $x_{ji}$= Amount of input J utilized by DMU I.

$v_k$ = Weight given to output k, $u_j$ = Weight given to input j

According to Khoveyni and Eslami (2013) the CCR model can be specified as follows:

$$Max \sum_{k=1}^{s} v_k y_{kp}$$

$$s.t \sum_{k=1}^{s} v_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0 \quad \text{..... (2.7)}$$

$$\sum_{j=1}^{m} u_j x_{jp} - 1$$

$$v_k, u_j \geq 0$$

Finally, the model which takes an input orientation that assumes variable (increasing and decreasing) returns to scale (BBC model) is specified as follows:

$$Min\theta - \epsilon(\sum_{k=1}^{m} S_k^- + \sum_{j=1}^{m} S_j^+) \quad \text{..... (2.8)}$$

$$s.t \sum_{i=1}^{n} \lambda_i x_{ji} + S_i^- = \theta x_{ji} \quad j = 1, \ldots\ldots, n$$

$$\sum_{i=1}^{n} \lambda_i x_{ki} + S_i^+ = \theta x_{ki} \quad k = 1, \ldots\ldots, n$$

$\lambda_j \geq 0 \quad j = 1, \ldots\ldots, n$

One strength of the DEA model is that it can be used to estimate both technical and scale efficiencies.

**Kendall's Coefficient of Concordance**

The Kendall's coefficient of concordance (W) will be used the rank the production and marketing constraints facing the major actors along the pineapple value chain. Kendall's W is an estimate of the variance of the row sum of ranks $R_i$ divided by the maximum possible value the variance can take (Steedle, & Shavelson, 2009); this occurs when all variables under consideration are in total agreement. Hence, $0 \leq W \leq 1$, 1 representing perfect concordance.

To compute the Kendall's W statistic, S is computed first from the row-marginal sums of ranks $R_i$ received by the objects.

$S = \sum_{i=1}^{n}(R_i - r)^2$ ..... (2.9)

Where S is a sum-of-squares statistic over the row sums of ranks$R_i$, and r is the mean of the $R_i$ values. Following that, Kendall's W statistic can be obtained from the following formula:

$W = \frac{12S}{m^2(n^2-n)-mT}$ ..... (2.10)

**EMPIRICAL REVIEW**

**The Profitability of Major Value Added Activities along the Pineapple Value Chain**

Researchers have used different approaches to study the profitability of the major value added activities along the pineapple value chain. Thus, these researches have looked at activities ranging from production through collection, transformation to trade. Techniques such as the Internal Rate of Return (IRR),

Net Present Value (NPV), the Gross Margin (GM), Benefit-Cost Ratio (BCR) the profit function etc. were used in the studies to estimate the profitability of the various activities along the pineapple value chain.

A study by Kuwornu, Nafeo and Osei-Asare, (2013) Using certified organic pineapple producers in the Central and Eastern Regions of Ghana as a case study, the financial viability per acre (0.4 ha) of certified pineapple over a five (5) year period was estimated, using the Net Present Value (NPV) and Internal Rate of Return (IRR) approaches, where cash flows were discounted to their present values. The Net Present Values are positive indicating that the production of certified organic pineapple in both Central and Eastern Regions of Ghana are financially viable. This was further confirmed by the estimated Internal Rate of Returns in both regions that were higher than the cost of capital and hence financially viable. The sensitivity analysis performed on the Net Present Values for both Regions revealed revenue to be the most sensitive and cost of Tools and consumables is least sensitive variable. This study although showed that pineapple production was financially viable for investors but failed to estimate the profit share of the producers as that will inform potential producers of pineapple whether to enter the industry or not.

Another study by Baruwa (2013) on the Profitability and constraints of pineapple production in Osun State, Nigeria used the multistage sampling technique to obtain information from 50 respondents using purposive and random selection. The gross margin and net profits in Naira (Nigerian currency) were N182 725 and N162 045, respectively. The study further indicated that, the availability of high yielding pineapple varieties, establishment of cold storages to reduce fruit perishability, agricultural price support programs, easier

access to credit from formal sources and farmers' education were considered essential to improve productivity and profitability of pineapple production in Nigeria. Furthermore, a study on the organic pineapple production in Ghana for smallholder farmers showed that organic production is more profitable for smallholders than conventional production and farmers collect a fair share of the price premium on the retail level (Yeboah et al., 2016).

According to a study by Asante & Kuwornu (2014) which sought to compare the profitability of pineapple-mango blend juice and pineapple fruit juice in Ghana, identified pineapple juice processing has a BCR of 1.03, which means that going into the pineapple juice processing is profitable. The value of the NPV (GHS 11,728.00) and IRR (23%) which further confirms that pineapple juice processing is profitable because the NPV is positive and the IRR is greater than the discounted factor (21%). The results also showed that it is more profitable to invest in the blend (pineapple and mango blend) than the pineapple juice alone as it yields a BCR of 1.36 which was greater than the BCR of 1.03 for the pineapple juice only. It was also found in a study by Das et al., (2016) that the pineapple production is remunerative but the marketing of pineapple in Ghana is done wrongly which lowers the marketers share of profit.

A study carried out by Abbey (2005) on the profitability and risk analysis of Ghana's pineapple marketing (exports) indicated that production and marketing of pineapple is a profitable business particularly to the marketer/exporter who buys from the out-grower and therefore do not bear the risks involved in farming pineapple. The study however noted that there are no crop insurance programs or options markets available for exporters and recommended that exporters could form cooperatives to present a unified front

to importers or explore agricultural insurance options. He suggested that to encourage agricultural diversification in general and to boost pineapple exports, government should provide some form of insurance for exporters to minimize their exposure to low prices on the European market. Balogun et al., (2018) also stated that the pineapple production business is profitable and returning more to the farmer than the original investment in terms of purchased inputs.

A study by Tey and Brindal (2015) on the factors influencing farm profits found that variables such as output, operational efficiency, operational scale, financial capacity and skills significantly influenced farm profit. Olujenyo (2008) also identified farming was profitable with gross margin and net returns of N2,637.80 and N2,141.00 respectively. The study further revealed that farm operations was in stage 2 of production with Returns to Scale (RTS) of .62. The results further showed that age, education, labour and cost of non-labour inputs were positively related to profit while farm size and years of experience carried negative signs. However, only labour input has significant influence on profit.

Onoja, Deedam and Achike (2012) assessed the profitability of cocoa farms in Nigeria's largest cocoa producing state. The Data was analyzed using descriptive statistics, budgetary analysis and OLS multiple regression models. The results showed that cocoa production is profitable with mean profit of US$10342.93. The determinants were labour, capital and seedlings planted.

Ehinmowo, Afolabi and Fatuase (2015) revealed that cassava processing business was profitable in the study area give the value of gross margin (N45,485,680.00; N33,476,280.00 and N64,517,720.00) and net profit (N45,231,752.00; N33,254,740.00 and N64,177,111.00) for the three States

(Ondo, Oyo and Ogun). The outcome of the regression model showed that the variables that determined profitability in the study area were education, year of experience, access to extension facilities, family size, price of raw materials and kinds of cassava bought. Adekanye, Ogunjimi & Ajala (2013) also researched gari-processing determinants among female processors in Kwara State, Nigeria and found that age and capital were the major determinants of profit in the research area.

In addition, Ajibade and Folayan (2019) highest qualification, association membership, ownership of oil palm plantations and the amount of palm oil generated determined profitability.

Arowolo, Shuaibu, Sanusi and Fanimo (2016) discovered that the marketing of cocoa beans in the study area is a lucrative venture with a gross margin of $137,719.27 (US$ 885.51) per month and a marketing margin of N40,600 (US$ 261.94). The marketing margin percentage was 34.73 percent, implying that marketers of cocoa beans realize a margin of 34.76 percent of the farm price. The result of the analysis of the OLS regression disclosed that transportation costs, communication costs, quantity of cocoa traded and credit union affiliation are the major determinants of the profit margin accruing to the marketer of cocoa beans.

Another study by Esiobu and Onubuogu (2014) revealed marketers earned a positive net return of N870.00 ($5.80) and return per capita invested was ₦ 0.78 ($0.0052). Estimated econometric analysis revealed that age (3.304), marital status (4.258), education (2.592), marketing experience (6.521), monthly income (3.485) and membership of cooperative (5.191) were found to be the significant factors influencing profit margin and the relationships were

statistically significant at 1% level of probability. F-Ratio was 52.152 indicating a high significant and strength of the econometric model at 1% level of probability. Wongnaa, Mensah, Ayogyam and Asare-Kyire (2014) discovered that wholesalers had a 99.7 percent bigger margin, while retailers had a 75.4 percent margin. Labor cost, purchase price, transport cost and selling price run as determinants of marketing profit through the entire estimated regression model.

**Difference in the Share of Profit received by the Major Actors along the Pineapple Value Chain**

Studies have shown that the major activities along the pineapple value chain are profitable, it is therefore prudent to find out if there exist any difference in the profit share of the actors. In a study conducted on the value chain analysis of tomato in the Kpone-Katamanso Districts of Ghana, Kumi (2017) identified farmers and marketers as the main actors along the tomato value chain. The study further showed that, the activities of these actors are profitable but the marketers (Distributors, wholesalers and retailers) receive the greater share of the profit. He further indicated that among the marketers, the retailer of the fresh tomato earned the highest profit of GHS 4.50 on every 5kg of fresh tomatoes sold.

Owusu-Adjei et al., (2017) carried out value chain analysis of groundnut in Ghana. Through mapping, value chain actors were identified to be primary producers (farmers), distributors, processors and retailers of output. Costs and returns estimates indicate that, for every liter of groundnut oil and kilogram of paste produced along the oil and paste chain respectively, the farmer benefits most when he or she sells groundnut in a shelled form. This is followed by the

distributor, the retailer of processed output and finally the processor. On the other hand, when the farmer sells groundnut in an unshelled form, the distributor benefits most from both the oil and the paste chain with 51% increase in profit.

Das et al., (2016) on the marketing systems and value addition of pineapple found farmers, processors and marketers as the major actors along the pineapple value chain. The study also found the activities of these actors are profitable but the marketer receives the greatest portion of the chain profit. It was therefore recommending that MoFA sets up a working governance structure for the pineapple industry to monitor the product pricing.

**Efficiency of the Major Actors along the Pineapple Value Chain**

Economic efficiency implies an economic state in which every resource is optimally allocated to serve each individual or entity in the best way while minimizing waste and inefficiency. When an economy is economically efficient, any changes made to assist one entity would harm another. Under this theme, empirical studies on both technical and scale efficiencies were reviewed. In a study conducted by Umanath and Rajasekar (2013) to analyse the technical and scale efficiency of farms in overall production of crops in Periyar-Vaigai irrigation system of Tamil Nadu which employed the data envelope analysis technique using 270 sampled respondents. The results of the study showed that there exist potential for increasing the profit further by 43 per cent in the farm holdings by following the best-practices of efficient farms. It was also indicated that about 47 per cent of the farms were not operating at optimal scale or nearer to optimal scale. The findings also indicated that all the farm inputs were used excessively by the sample respondents.

Kathiravan, Rajasekar and Saranya (2018) identified that that the technical inefficiency was less in irrigated farms than in dry farms. Similarly, the scale inefficiency was found high in dry farms than in irrigated farms. Even though differences exist in mean technical and scale efficiency among dry and irrigated farms it was recommended that the findings could be helpful to farming community and policy makers to undertake necessary action to improve the current level of technical and scale efficiency. Similarly, Balogun et al., (2018) also found that farms were operating inefficiently with efficiency score of 0.603. It was recommended in the study that policy makes production inputs available to pineapple farmers in proportion they can afford.

Oktari, Waluyati and Suryantini (2016) employed the Data Envelopment Analysis (DEA) method with Constant Return to Scale (CRS) assumption through input oriented approach was used to know the levels of the pineapple chips producers' relative efficiency. The study revealed that that most of the pineapple chips producers are inefficient (13 out of 21) or 61.90%, while only 8 out of 21 or 38.10% were efficient. A study on the technical, allocative and economic efficiency of pineapple production in West Java Province, Indonesia by Lubis et al., (2014) found that farmers were inefficient in the pineapple production with mean technical, allocative and economic efficiency level of 70.1%, 34.1% and 24.1%, respectively. A Tobit regression model results on the determinants of fifteen socio-economic, demography and institutional variables revealed that land productivity had positive and significant contribution on technical and economic efficiency. Market distance and capital productivity had positive and significantly influenced the technical efficiency and labor productivity also land ownership had positive and

significant contribution to the economic efficiency. Counseling and off-farm income contributed negatively to the technical efficiency and farmer experience also contributed negatively to the economic efficiency. These finding suggests that pineapple production in the research location would be significantly improved by cultivating on farmer's own land and getting better counseling from about the pineapple's good agricultural practices. Kapya (2016) also found that there are sufficient growth opportunities in Zambia's agro-processing industry, but the industry is highly inefficient. The average technical efficiency was 42.5 percent while scale efficiency was 81.7 percent. The study also shows that firm efficiency is affected by firm size, the size of the firm's market share, labour costs, and location of the firm.

Shehu et al., (2007) investigated the productivity and technically efficiency of small-scale farmers in Adamawa State, Nigeria using stochastic frontier production function. The empirical results indicate that the farmers were operating in the irrational stage of production (stage I) as depicted by the returns to scale of 1.06. The predicted technical efficiencies for the farmers ranged from 74% to 98.9% with a mean of 95.7%. Improvement on farmers' educational levels through adult education and literacy campaign as well as regulating household size by advocating the need for family planning would probably lead to improvement in technical efficiency in the long term. Nchare (2007) studied the factors affecting the technical efficiency of Arabica coffee producers in Cameroon using the TRANSLOG stochastic production frontier function. The mean technical efficiency index of the 140 farmers during the 2004 crop year was estimated to be 0.896. It was found that the educational level

of the farmer and access to credit were the major socioeconomic variables that influenced farmer's technical efficiency.

A study El-Megharbel (2010) on the efficiency of wholesale and retail distribution services in Egypt used the Data Envelopment Analysis (DEA) to estimate the technical efficiency of retailers and wholesalers. The study found that the retailers and Wholesalers in Egypt were technically efficient. Assaf, Barros and Sellers-Rubio (2011) also found that the retail stores in the study area were technically inefficient. The study further revealed that longer years in business, stronger geographical presence, and lower price offerings. Vertical integration, on the other hand, is negatively related to efficiency.

Sellers-Rubio and Más-Ruiz (2009) found that retailers in food industry were technically efficient with a mean technical efficiency of .95. The study also used panel data to show that inventory investment and wage level have a positive impact on technical efficiency.

**Constraints of the Activities of the Major Actors along the Pineapple Value Chain**

Constraints can be measured using the Kendall's Coefficient of Concordance; the Garrett's ranking technique and sometimes the direct scoring method. However, the Kendall's Coefficient of Concordance is preferred in this study.

Donkoh and Agboka (1995) identified pests and diseases (*mealybug wilt disease, Phytophthora, soil pests*), weeds, soil fertility, harvesting and post-harvest handling methods, and environmental degradation. Economic constraints comprise credit and price fluctuations as the constraints expected to affect future production of pineapple.

A study by Iwuchukwu et al., (2017) on the problems and prospects of pineapple production in Enugu State of Nigeria which employed purposive sampling technique was used to select eighty (80) pineapple farmers from two agricultural zones. The results showed that major potentials of the area for pineapple production included: availability of fertile land for pineapple production (mean=2.78), ready market for the sale of the crop produce (mean =2.72), a good source of income (mean =2.62), and good health through consumption among farmers/inhabitants (mean =2.78). The major constraints of pineapple production identified by the respondents were poor access road for transportation of produce (mean =2.56), and lack of technical knowledge on the use of improved technology (mean =2.56). Similarly, Madulu and Chalamila (2007) conducted a study on the 'Potential and Constraints of Fruits trees in the Coastal region in Tanzania. In their constraint analysis it was found out that farmers' major constraints were lack of reliable markets, lack of improved varieties, lack of improved production and processing know how; and pests and diseases. The most important problem was lack of reliable market. The percentage score for the constraints were 75% for lack of reliable markets; 50% for lack of improved varieties; 45% for lack of improved production and processing know how and 30% for incidences of pests and diseases. They concluded that pineapple, cashew nut and oil palm were potential source of households' income replacing coconut in the study area.

However, the major constraints of farmers were efficient marketing system and technological knowhow.

Achuonjei et al., (2005) in their research dubbed "Ghana Sustainable horticultural export chain", indicated the most significant problem or constraint

areas in the field of logistics with respect to pineapple production are; poor infrastructure, poor quality of the means of transport used, lack of refrigeration facilities resulting in inferior product quality, the exported volumes being too low and the freight cost also being too high. A study conducted by Jaji et al., (2018) also found credit access, pineapple varieties, distance to the market, cost of input, price of pineapples and extension services as the major constraints to pineapple production. Baruwa (2013) also identified limited availability of high quality planting materials, high fruit perishability, low fruit prices, low access to credits and plant diseases as the major production and marketing challenges faced by the pineapple producer.

Adaigho and Okpeke, (2018) identified the potentials of pineapple production in the area. These includes; boosting of income (mean =2.60), promotion of good health through consumption among farmers ((mean =2.52) and checking of social vice because of idleness (mean =1.84) among others. The study also found lack of improved planting materials, high fruit perishability and low fruit price etc. as the major problems of pineapple farmers. Akhilomen et al., (2015) in a similar identified a number of constraints, such as inadequate credit facilities, weather and disease, poor network of roads, high transportation cost, lack of land & herbicides and poor extension services as the major constraints that hinder pineapple production.

Another study by Emodi et al., (2016) found that the factors affecting pineapple production included no guidance and monitoring by extension agents (x=3.08), no access to fertilizers and pesticides (mean=3.10). Also revealed as farmers' major enhancing factors in pineapple production were increased supply of pineapple sucker, fertilizer and pesticide (mean=3.34), technical

guidance and training by extension agents (mean=3.22), assistance in marketing of pineapple (mean=3.17). The study recommended that small-scale pineapple farmers should be provided with relevant and timely supply of farm inputs, information, guidance and training to boost production. Awareness on the various health benefits of pineapple should also be increased to improve its market demand.

Matere (2009) concluded that irrigation facility on the farm, availability of family labor for farming activities, access to credit for agricultural development, contact with agricultural extension service providers, good condition of roads and access to market information were the major constraints facing banana producers and marketers in Kenya.

Adelaja, Nayga Jr., Schilling and Tank (2000) found that the area of environmental and other regulation is the most problematic for food processors. Other areas of concern include, in order of importance, taxation and fiscal problems, economic barriers to development and expansion, high cost of doing business, education, training and labor concerns, communication and public relations, and transportation. Singh, Tegegne and Ekanem (2012) examined the trends and status of the food processing industry, identifies and discusses constraints/problems slowing down its growth. Though there are many promising dynamics, which support the potential for growth of this industry, there are still some significant constraints that, if not addressed sooner, can impede the growth prospects of the Food Processing Industry in India.

Ruteri and Xu, (2009) on the supply chain management and challenges facing the food industry sector in Tanzania found that the sector still faces a number of factors that impede the firms to grow fast and compete in the global

market. Such factors include technical knowledge, research and development, capital, managerial and physical infrastructures.

Njikam (2003) estimated the pre and post trade reform stochastic frontier production functions for seven Cameroonian industrial sub-sectors. The study found the mean technical efficiency of the firms in the pre-trade reform as 83.78 and that of the firms in the post-trade reform to be 81.87. The study concluded that the firm-specific technical efficiencies in the post-trade reform period was significantly different from that of the pre-trade reform period. Also, a study by Bhasin and Akpalu (2001) on the technical efficiency of women entrepreneurs engaged in hairdressing and male wood processors of Cape Coast, Ghana, found that the efficiency of the women entrepreneurs was significantly different from the efficiency of the male wood processors.

**Sustainability of the Activities along the Pineapple Value Chain**

Sustainability assessment as basis for development of sound farming practices has become a key focus for many researchers, policy makers and development studies throughout the world. There is increased interest in creating multifunctional systems. Such systems can enhance farmer's livelihoods, reinforce local food security, preserve natural resources, improve (bio) diversity, among many more socio-ecological functions and services, which is essential in the context of structuring sustainable farming systems.

Badu-Gyan (2015) found that physical factors contracts with certified organic pineapple exporters or processors, training on organic production, access to support services from governmental or non-governmental organizations, and availability and access to the certified organic market are to be considered to ensure sustainability of the pineapple sector.

Gamboa (2014) and Inkoom, Dadzie, Akaba, Annor-Frempong and Afful (2019) concluded that the activities by the farm households was moderately sustainable. Gamboa recommended that there is the need to study resource use efficiency and farm performance to ensure the sustainability of the farm business.

Akaba (2018) on climate change responses, food security and production sustainability of maize farmers in the Volta Region of Ghana revealed that farmers have positive attitudes towards sustainable agriculture.

**Summary of Literature Review**

This chapter has reviewed literature related to the study. In order to put the study in perspective, empirical studies, models and concepts related to value addition and the value chain concept was considered. The study reviewed literature on the origin of the value chain concept, agricultural value chain, principles underlying the concept of value chain in agriculture, assumptions and the characteristics of the value chain approach and pineapple value chain. The review on pineapple value chain brought out such actors as input dealers, farmers, handlers, processors, marketers and consumers who play numerous roles along the pineapple value chain.

Further, the review looked at some theoretical underpinnings of the study. The study is guided by theories such as; the supply chain management theory, supply chain management theory and supply networks, innovations theory of profits and efficiency analysis (Data Envelopment Analysis).

The study finally reviewed empirical studies with regards to the objectives stated in chapter one. In was revealed in the review that the major actors along the pineapple value chain were producers, processors and marketer

(retailers and wholesalers) as the major actors along the pineapple value chain. The review further showed the activities these actors are profitable but the marketer receives a greater share of the profit, this indicates there are differences in the profit share of the various actors along the pineapple value chain. It was further shown that these actors are operating at about 40 to 80 percent efficiency level and are constrained with problems such as availability of fertile land for pineapple production, ready market for the sale of the crop produce, a good source of income, good health through consumption among farmers'/inhabitants poor access road for transportation of produce, and lack of technical knowledge on the use of improved technology. Most of the studies reviewed suggested that, the activities of the actors can be sustained only when resources are efficiently allocated and farm performance also improved to increase profitability and efficiency levels.

# CHAPTER THREE

# RESEARCH METHODS

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. This chapter looked at methods employed in order to conduct the study. It comprised the research design, study area, population, sampling procedure, data collection instrument, pre-test, data collection procedure and data processing and analysis.

## Research Design

Newing (2011) says that both for the general method (research methodology) and, more specifically, for the research design framework, the term 'research design' is used. A research design is, according to Lavrakas (2008), a general plan or strategy for undertaking a research survey to examine particular interesting testable research issues.

This study employed the cross-sectional descriptive survey design to look into the value added activities along the pineapple value chain in selected districts in the Central Region. The survey method involves asking respondents questions, and also collecting information from a smaller number of people to be the representative of a larger group. The descriptive survey design was used in this study because a sample was drawn from the population, and their responses were analszed in numerical terms. Further, the descriptive survey design was used because it is relatively quick and easy to conduct (no long periods of follow-up). Data on all variables is only collected once. It is able to measure prevalence for all factors under investigation and is also good for descriptive analyses and for generating hypotheses (Babbie, 2007). Aside the strengths of the descriptive survey design, it has a difficulty in determining

whether the outcome followed exposure in time or exposure resulted from the outcome.

**Study Area**

The research was carried out in chosen districts in Ghana's Central Region which is one of Ghana's sixteen administrative regions. It is bordered by regions of Ashanti and Eastern to the north, Western to the west, Greater Accra to the east, and the Gulf of Guinea to the south. The Central Region has 20 districts with a total land area of 9,826 km2 (3,794 sq. mi). However, the study specifically concentrated on three (3) out of the 20 districts, the selected districts for the study include Abura-Asiebu-Kwamankese district (AAK), Komenda-Edina-Eguafo-Abirem district (KEEA) and Ekumfi district. In the selected districts, farming is seen as one of the major occupations that drives their economies where staple crops such as pineapple, orange, watermelon and others are grown.

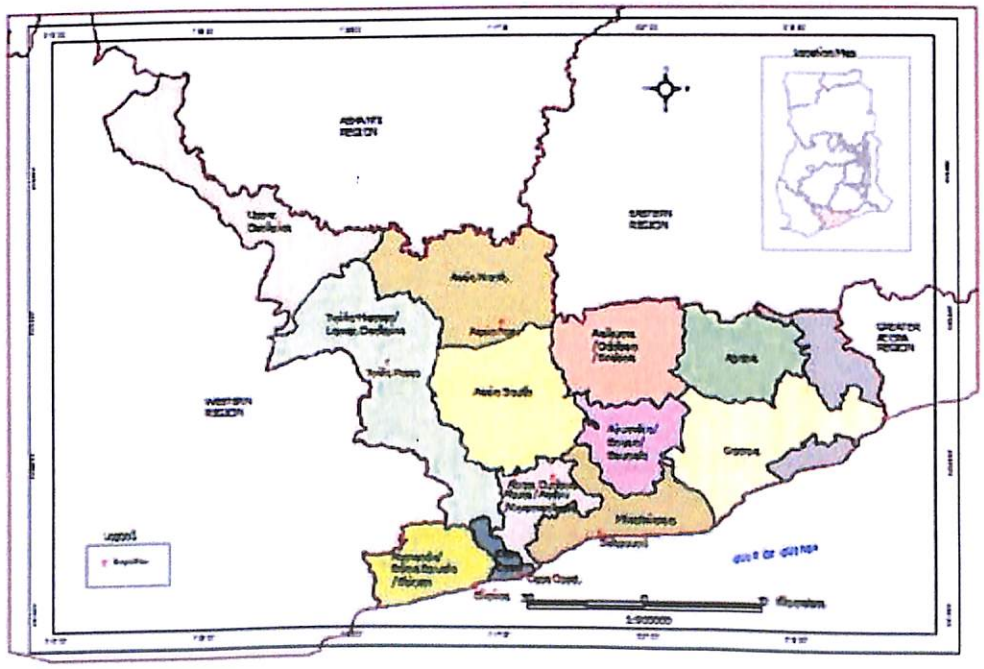


*Figure 3*: Map of Central Region of Ghana showing districts

AAK District covers a land area of about 380 sq. km. The District has about 262 communities, with Abura Dunkwa as its capital. The District population as given in the 2010 PHC was 117,185. Based on the estimated growth rate of 2.6%, the population as at 2017 is estimated to be 141,162. The district has more females than males with a sex ratio of 89.3.

The Municipality is bounded on the South by the Atlantic Ocean (Gulf of Guinea), the East by the Cape Coast Metropolis, the North by the Twifo-Hemang-Lower Denkyira District and the West by the Mpohor-Wassa East District, bound the Municipality on the South by the Atlantic Ocean (Gulf of Guinea), the East. Perched between longitude 10 20' West and 10 40' West and latitude 50 05' North 150 North the District covers an area of 372.45 kilometers square (919.95 square miles). There are four paramouncies in the Municipality; these are Komenda with the paramount seat at Komenda, Edina with the Paramount seat at Elmina, Eguafo with the paramount seat at Eguafo and Abrem with the paramount seat at Abrem Berase. According to the 2010 population and housing census report gave the Municipal population at 144,705. The total population for Male is 69,665 and Female is 75,040 representing 48.14% and 51.86% respectively.

The Ekumfi District is one of the districts in the Central Region of Ghana. Its capital is Essarkyir. The district was established in June 2012, when it was carved out of the Mfantsiman Municipal District. Ajumako /Enyan /Essiam District borders the district to the north to the east by Gomoa East District, to the south by the Gulf of Guinea, and to the west by Mfantsiman Municipal District. The total area of the district is 276.65 square kilometers. According to the 2010 census, the population of the district is 52,231

## Population

The target population for the study was 1941 smallholder pineapple farmers, 80 processors and 300 marketers of pineapple in Abura-Asiebu-Kwamankese, Komenda-Edina-Eguafo-Abirem and Ekumfi districts in the Central Region. The population comprises people from diverse cultural and educational backgrounds. The accessible population comprise smallholder pineapple farmers, processors and marketers across the target population.

## Sampling procedure

The population for the study was all smallholder pineapple farmers, processors and marketers of pineapple in Abura-Asiebu-Kwamankese, Komenda-Edina-Eguafo-Abirem and Ekumfi districts in the Central Region. The sampling frame for the pineapple farmers was 15 farmers for the Abura-Asiebu-Kwamankese district, 875 farmers for Komenda-Edina-Eguafo-Abirem district and 1051 for Ekumfi district that was gotten from the Department of Agriculture in the selected Districts in the Region. Further, because the sample frame for the processors and marketers is not known, the snowball technique was employed by the researcher to reach processors and marketers as possible to obtain the sampling frame for the processors and marketers. The sample frame for the processors was 10 for Abura-Asiebu-Kwamankese district, 25 for Komenda-Edina-Eguafo-Abirem district and 45 for Ekumfi district. The sampling frame for the marketers was 55 for Abura-Asiebu-Kwamankese district, 152 for Komenda-Edina-Eguafo-Abirem district and 93 for Ekumfi district.

The sample size determination table (see Appendix H) for a given population by Krejcie and Morgan (1970) was used to delineate the sample size

for the study based on the sample frame(s). As a result, 320 smallholder pineapple farmers, 66 pineapple processors and 169 pineapple marketers were used. The researcher also made a provision of 10% of each of the samples selected to take care of non-response and other errors that might occurred during data collection.

The multi stage sampling technique was used in selecting the respondents for the study. The study purposively selected three pineapple growing districts in the study area in stage one. In the second stage, the study randomly selected nine (three communities from each district) pineapple growing communities from the three districts. Finally, the study based on the sampling frame(s) employed the random sampling technique to select the respondents (farmers, processors and marketers) for the study.

*Table 1* - Sample Size

| District | Population | Sample |
|---|---|---|
| Farmers | | |
| AAK | 15 | 3 |
| KEEA | 875 | 144 |
| Ekumfi | 1051 | 173 |
| Sub-Total (a) | 1941 | 320 |
| Processors | | |
| AAK | 10 | 8 |
| KEEA | 25 | 20 |
| Ekumfi | 45 | 38 |
| Sub-Total (b) | 80 | 66 |
| Marketers | | |
| AAK | 55 | 30 |
| KEEA | 152 | 87 |
| Ekumfi | 93 | 52 |
| Sub-Total (c) | 300 | 169 |

Source: Boakye (2018)

**Data Collection Instrument**

The study employed three researcher designed interview schedules for small scale pineapple farmers, processors and marketers. The first instrument was used to solicit information from smallholder pineapple farmers in the selected districts in the Central Region (see Appendix A). The instrument was in five sections (A-E); section A gathered information on the socio-economic characteristics such as age, gender, size of farm, variety of pineapple produced, source of finance, access to extension service and the type and source of the service. Further, Section B solicited information on the various marketing channels used by the smallholder pineapple farmers with regards to the production of pineapple fruits. Section C of the instrument also consider the cost of production, output and sales. In section D, the production and marketing constraints of pineapple production were considered. The final section also looked at the sustainable practices by pineapple farmers in the study area.

The second instrument gathered information from pineapple processors in the study area (see Appendix B). The instrument was in four sections (A-D); section A gathered information on the socioeconomic characteristics of pineapple processors in the study area. Section B then looked at the cost of production, output and sales of pineapple processors. In addition, the constraints to pineapple processing was considered under section C and Section D looked at sustainable practices by pineapple processors in the study areas.

The third instrument was used to gather information from marketers of pineapple in the selected districts in the study areas (see Appendix C). The instrument was in five sections (A-E); section A gathered information on the socio-economic characteristics of pineapple marketers in the study areas.

Section B collected data on the various marketing channels used in the study areas. Further, section C collected data on the marketing margins while section D looked at the constraints faced by pineapple marketers in the study areas. In section E, sustainable marketing practices by the marketers was looked at.

**Pre-test**

Before the instruments were sent to the field for the pre-test data collection, copies of the instruments were submitted to the supervisors to examine whether the number and type of items in the instruments measures the concepts or constructs of interest. Based on supervisors' comments, the researcher made the changes required with rewording, adding or deleting some items which were needed.

The pre-test data collection exercise was conducted from the 13th to 15th of February, 2018 at the Gomoa West district and Effutu municipality where the researcher together with three (3) trained assistants guided the data collection process. The data collected was entered into IBM Statistical Package for Social Sciences (SPSS) version 25.0 software and thoroughly cleaned for statistical analysis. The results for the pretest data analysis have being presented in Table 2.

Table 2 - *Cronbach's Alpha and Guttman's Lambda-2 Reliability Test Scores*

| Construct | Farmers | | Processors | | Marketers | |
|---|---|---|---|---|---|---|
| | Alpha | Items | Alpha | Items | Alpha | Items |
| Constraints | 0.74 | 13 | 0.70 | 11 | 0.70 | 9 |
| | Lambda | Items | Lambda | Items | Lambda | Items |
| Sustainability | 0.84 | 11 | 0.82 | 13 | 0.80 | 13 |

Source: Field survey, Boakye (2019)

The Cronbach's Alpha reliability coefficient was computed for the constraints which showed an alpha of 0.74 for the instrument for pineapple farmers, 0.70 for the instrument for pineapple processors and 0.70 for the instrument for pineapple marketers. According to Pallant (2005), an instrument with a reliability coefficient .70 or above is reliable and appropriate for data collection. Also, the Guttman's Lambda-2 was used to determine the internal consistency of the sustainability construct. Osburn (2000) puts it that Guttman's Lambda-2 is a relevant tool for measuring the internal consistency of a dummy construct. Table 2 showed a coefficient of 0.84 for the sustainability items in the farmer instrument. This implies that, 84% of the variance is due to true scores and 16% is due to error. Similarly, the processor instrument had a coefficient of 0.82, indicating 82% of the variance in the instrument is due to true scores and 18% of the variance is due to chance. Finally, the Guttman's Lambda coefficient for the marketer instrument was 0.80. This means that 80% of the variance in the construct is due to true scores where as 20% is due to error. The pre-test results was used to validate the instruments for the study in terms of rearrangement, rewording on the omission of items that were not relevant for the study.

**Data Collection Procedure**

The researcher together with 10 trained research assistants from the Department of Agricultural Economics and Extension conducted the data collection excercise. The research assistants were trained on the purpose of the study and the administration of the instrument. The respondents were assured of a maximum security of the information they gave us since the study was mainly for the purpose of academics.

The data collection exercise was conducted between 22nd March and 12th April, 2019. The instrument(s) were sent to the respondents in their various homes, farms and selling points. The hired assistants guided the respondents to fill their responses or fill it for them in a form of an interview. In all, 352, 72 and 186 of the instruments for farmers, processors and marketers respectively were sent out for data collection.

After the data collection exercise, 327 out of 352 of the instruments sent to the farmers were retrieved representing 92% response rate. Out of the 72 instruments sent out to collect data from the pineapple processors 68 were retrieved and 175 out of 186 instruments for the marketers were also retrieved representing 94% for both processors and marketers.

**Errors in Data**

Like all household surveys, a number of factors limit the quality of the data collected for the study. Many individuals especially those in the informal sector do not keep record of their activities. In the light of this, approximations have to be made for most of the variables of interest. In cases of some variables like income and age, there was no option than to make approximations for most individuals. However, such approximations if not done with caution can have some negative effects on the estimation and the results.

Another factor worthy of mention is language. Translation of the items in the questionnaire from English to the local language of the people can pose a problem concerning accuracy and quality of data when translation is not done properly.

The researcher in dealing with the errors made sure the enumerators were well vexed with the local language to aid better interpretation of the items

on the instrument to the respondents. In addition to this, approximations for the incomes and cost of inputs were done based on the existing market prices of the inputs and outputs.

**Data Processing and Analysis**

The data was analysed using the IBM Statistical Package for Social Sciences (SPSS) version 25.0 software. The data analysis was done according to the research objectives.

The profitability of the actors along the pineapple value chain was determined by employing the gross margin analysis and the profit function using the Cobb-Douglas functional form. The profit function helped to determine what causes an actor's activity to be profitable or not to be profitable. The Kruskal Wallis Test for K-independent samples was employed to determine whether there exists any difference in the profit share of the major actors along the pineapple value chain. In the same way, the Kruskal Wallis Test was used to compare the differences in the efficiencies of the actors (farmers, processors and marketers)

In analysing objective two, the study employed the Data Envelope Analysis (DEA) technique to determine the efficiency (technical and Scale) of the major actors along the pineapple value chain in the Central Region.

To determine the production and marketing constraints of the major actors along the pineapple value chain in the study area, the Kendall's coefficient of concordance was used to rank the constraints. Further, the sustainability of the activities along the pineapple value chain in the Central Region was determined using the Sustainability Index model.

**Estimation Technique for Profitability**

**Gross Margin (GM)**

Gross margin, indicates how much profit a firm makes after paying off its cost of goods sold. It is a measure of the efficiency of a firm using its raw materials and labor during the production process.

Gross Margin (GM) = Revenue – Cost of goods sold ..... (3.1)

**The Profit Function**

A profit function is a function that focuses on business applications. The primary purpose for a business is to sell a product or service in order to make a profit, which is the revenue a company receives for selling a product or service less the cost for creating a product or service. The profit function equation is made up of two primary functions: the revenue function and the cost function. If x represents the number of units sold, these two functions are named as follows:

$R(x)$ = the revenue function ..... (3.2)

$C(x_i)$ = the cost function. ..... (3.3)

Therefore, the profit function equation can be specified as follows:

$P(x_i) = R(x) - C(xi)$ ..... (3.4)

The input is the domain of the function and the output is the range of the function. The domain is usually represented by the variable x and it is called the independent variable. Each value used for the independent variable produces an output value that is unique to the independent variable. In other words, each input has only one output. The output, or range, of a function is represented by the variable y.

The study employed the Cobb-Douglas functional form to estimate the profit function of the actors. According to Brown (2017) the Cobb-Douglas function can be specified as:

$$Y = AL^{\beta}K^{1-\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.5)$$

Where A is total factor productivity, L is the labour input, K is the capital input and $\beta$ and $1-\beta$ are the out elasticities and A is the total factor productivity. Output elasticity measures the responsiveness of output to changes in the concentrations of either labor or capital used in manufacturing (Brown, 2017). Applying the model to the estimation of the profit function of farmers in the study, the model is specified:

$$\pi \sim f(R, L, K, A, P) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.6)$$

Where $\pi$ is the profit of the farmer, R is the revenue from the farm activity, L is the cost of labour, K is the cost of capital, A is the cost of agro-chemicals used and P is the cost of planting materials (suckers) used at the farm. The profit function for the processor is also specified as:

$$\pi \sim f(R, L, K, F, P) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.7)$$

Where $\pi$ is the profit of the processor, R is the revenue from the pineapple processing activity, L is the cost of labour, K is the cost of capital, F is the cost of pineapple fruits used and P is the cost of packaging the processed pineapple.

For the marketers, the profit function was specified:

$$\pi \sim f(R, T, L, P, S) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.8)$$

Where $\pi$ is the profit of the marketer, R is the revenue from the pineapple marketing activity, T is the transportation, L is the cost of labour, P is the cost

of packaging and S is the cost of storing the fruits. The variables used in all the models were in their natural logarithm form.

**Estimation Technique for Technical and Scale Efficiency**

The Data Envelopment Analysis (DEA) technique allows the researcher to estimate both technical and scale efficiencies and hence was employed to estimate the efficiencies of the major actors along the pineapple value chain. The DEA is a linear programming technique for measuring the relative performance of organizational units where there is the presence of multiple inputs and outputs which makes comparisons difficult.

Assuming there are n Decision Making Units (DMUs), each with m inputs x outputs, the relative efficiency score of a test DMU p is obtained by solving the following model by Charnes, Cooper and Rhodes, (1978):

$$Max \sum_{k=1}^{s} v_k y_{kp} \Big/ \sum_{j=1}^{m} u_j x_{jp}$$

..... (3.9)

$$\sum_{k=1}^{s} v_k y_{ki} \Big/ \sum_{j=1}^{m} u_j x_{ji} \leq 1 \forall_i$$

Where:

K=1 to s, j=1 to m, i=1 to m

$y_{ki}$ = Amount of output K produced by DMU I, $x_{ji}$= Amount of input J utilized by DMU I.

$v_k$ = Weight given to output k, $u_j$ = Weight given to input j

In order to solve the model, there is the need to convert equation (3.9) into a linear programming formulation. That is given by:

$$Max \sum_{k=1}^{s} v_k y_{kp}$$

$$s.t \sum_{j=1}^{m} u_j x_{jp} = 1$$

$\sum_{k=1}^{s} v_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0 \; \forall_i$ ..... (3.10)

$v_k, u_j \geq 0 \; \forall k, j$

The dual problem can therefore be specified as follows:

Min θ

$\sum_{i=1}^{n} \lambda_i \, x_{ji} - \theta x_{jp} \leq 0 \; \forall j$

$\sum_{i=1}^{n} \lambda_i \, x_{ki} - y_{kp} \geq 0$ ..... (3.11)

$\lambda_i \geq 0 \; \forall i$

Where:

$\theta$ = Efficiency score, and $\lambda s$ = dual variables

According to Khoveyni, Eslami, Khodabakhshi, Jahanshahloo & Lotfi, (2013) there is an alternative model to estimate the most productive scale size (MPSS) based on the optimal solution of constant return to scale (CRS) also called CCR model and variable return to scale (VRS) called the BCC model.

*Constant Return to Scale (CRS)*

This model shows a change in the amount of output that is proportional to the change in the sum of all inputs used. For example, if the capital or input is added by x times then the output also increases by x times. Cooper, Seiford & Zhu, (2011) the linear form of the CCR model are as follows:

$Max \sum_{k=1}^{s} v_k \, y_{kp}$

$s.t \sum_{k=1}^{s} v_k y_{ki} - \sum_{j=1}^{m} u_j x_{ji} \leq 0$ ..... (3.12)

$\sum_{j=1}^{m} u_j \, x_{jp} - 1$

$v_k, u_j \geq 0$

*Variable Return to Scale (VRS)*

In this model there are two types of variable return to scale, that are:

- Decreasing Return to Scale

Decreasing return to scale occurs when the number of output changes is not proportional (smaller) than the input change.

- Increasing Return to Scale

  Increasing return to scale occurs when changes of all inputs will result in larger output changes than the proportion of input changes.

According to Cooper et al., (2011) the linear form of the BCC model is expressed as follows:

$$Min\theta - \epsilon(\sum_{k=1}^{m} S_k^- + \sum_{j=1}^{m} S_j^+) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.13)$$

$$s.t \sum_{i=1}^{n} \lambda_i x_{ji} + S_i^- = \theta x_{ji} \quad j = 1, \ldots\ldots, n$$

$$\sum_{i=1}^{n} \lambda_i x_{ki} + S_i^+ = \theta x_{ki} \quad k = 1, \ldots\ldots, n$$

$$\lambda_j \geq 0 \quad j = 1, \ldots\ldots, n$$

$$\text{Scale Efficiency} = {}^{Efficiency\ in\ CRS}/_{Efficiency\ in\ VRS} \quad \ldots\ldots (3.14)$$

Where:

CRS – Constant Returns to Scale

VRS – Variable Returns to Scale

**Estimation Technique for Measuring the Sustainability of Practices by the Major Actors along the Pineapple Value Chain**

The study employed the approach used in a study by Inkoom et al., (2019) to assess the extent to farmers adopt sustainable practices in agricultural production activities. The study employed 17 recognisable items accepted as an instrument for assessing the sustainability of agricultural practices, taking into account their suitability for the local environment. The study further employed 13 and 15 recognizable items as tools for measuring the sustainability of the activities by the processors and marketers. They involve practices that impact

the environment positively and negatively. Sustainable practices response items were presented to the actors to identify those practiced. Responses by the actors were scored -1, 0 and 1, where 1 represents the case where an actor uses the sustainable practice and -1 and 0 meant the opposite. For a positive statement, is an actor responded "yes" it was assigned a score of +1 or 0 if the response was "no". Also, a "yes" response to a negative statement was scored -1 or +1 if the response was "no" (Inkoom et al., 2019).

The total scores assigned to the practices by the $i^{th}$ actor (farmer, processor or marketer) was summed up. The sustainability index for the $i^{th}$ actor was computed by taking the score assigned to the actor by the total list of sustainable practices presented to the actor (Inkoom et al., 2019). The formula for computing the sustainability index is specified as:

$$SI = \Sigma(n^{+} + n^{0} + n^{-})/_{N} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.15)$$

The research also used the cluster analysis to examine and classify actors' activities based on their calculated sustainability index. This, therefore, provided the chance for actors to be distributed along the scale of the sustainability index.

**Estimation Technique for Ranking the Production and Marketing Constraints of the Major Actors along the Pineapple Value Chain**

The Kendall's coefficient of concordance (W) was used to the rank the production and marketing constraints facing the major actors along the pineapple value chain. Kendall's W is an estimate of the variance of the row sum of ranks $R_i$ divided by the maximum possible value the variance can take (Steedle, & Shavelson, 2009); this occurs when all variables under

consideration are in total agreement. Hence, $0 \leq W \leq 1$, 1 representing perfect concordance.

To compute the Kendall's W statistic, S is computed first from the row-marginal sums of ranks $R_i$ received by the objects.

$$S = \sum_{i=1}^{n}(R_i - r)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.16)$$

Where S is a sum-of-squares statistic over the row sums of ranks $R_i$, and r is the mean of the $R_i$ values. Following that, Kendall's W statistic can be obtained from the following formula:

$$W = \frac{12S}{m^2(n^2-n)-mT} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.17)$$

Where n is the number of objects and m is the number of variables under consideration. T is a correction factor for tied ranks:

$$T = \sum_{k=1}^{g}(t_k^3 - t_k) \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.18)$$

In which $t_k$ is the number of tied ranks in each (k) of g groups of ties. The sum is computed over all groups of ties found in all m variables of the data. T = 0 when there is no tied value.

**Testing the Significance of Kendall's W**

The Friedman's chi-square statistic was used to test the significance of the Kendall's W statistic. Friedman's chi-square statistic is obtained from W by the formula:

$$X^2 = m(n-1)W \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.19)$$

This is asymptotically distributed like chi-square with v = (n-1) degrees of freedom; it can be used to test W for significance. An alternative approach is to compute the following F statistic:

$$F = {(m-1)W}/{(1-W)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3.20)$$

Which is asymptotically distributed like the F with $v_1 = n - 1 - \left(\frac{2}{m}\right)$ and $v_2 = v_1(m-1)$ degrees of freedom. Kendall and Babington smith described this approach using a fisher z transformation of the F statistic, z = 0.5 $log_e$(F). It was recommended for testing W for moderate values of n and m.

**Chapter Summary**

This chapter of the study looked at the research methods to be employed in the study. The methods include the research design, description of the study area, description of the study population including sampling procedure. The chapter also looked at the data collection instrument and method as well as the data analysis procedure. The models to be used in the study were also specified in this chapter: the specified models for the study include the gross margin and profit functions, the Data Envelopment Analysis (DEA) technique, the Hichet model and the Kendall's coefficient of concordance technique.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. This chapter dealt with how the collected data was analysed, as well as the interpretation of the results.

## Socioeconomic Characteristics of Respondents

The section entails the presentation of socioeconomic data of respondent. These data include sex, age, marital status, experience. Tables 3, 4, 4, and 6 gives the summary of the socioeconomic data.

Table 3 - *Socioeconomic and farm related Characteristics of pineapple Farmers*

| Variable | Categories | F | % | $\bar{X}$ | SD |
|---|---|---|---|---|---|
| Age (years) | 30 & Below | 24 | 7.4 | | |
| | 31 – 40 | 103 | 31.6 | | |
| | 41 – 50 | 117 | 35.9 | | |
| | 51 – 60 | 48 | 14.7 | | |
| | 61 & above | 34 | 10.4 | 45 | 10.7 |
| Sex | Male | 241 | 73.7 | | |
| | Female | 86 | 26.3 | | |
| Marital Status | Single | 13 | 4 | | |
| | Married | 301 | 92 | | |
| | Divorced | 10 | 3.1 | | |
| | Widowed | 3 | .9 | | |
| Level of Education | No formal education | 40 | 12.5 | | |
| | Primary | 40 | 12.2 | | |
| | JHS/Middle school | 219 | 67 | | |
| | SHS/Technical/Vocational | 23 | 7 | | |
| | Tertiary | 4 | 1.2 | | |
| Occupation | None | 242 | 74 | | |

Table 3, continued

| | | | | | |
|---|---|---|---|---|---|
| | Civil servant | 5 | 1.5 | | |
| | private | 80 | 24.5 | | |
| Farming Experience (years) | 10 & Below | 164 | 50.2 | | |
| | 11 – 20 | 85 | 26 | | |
| | 21 – 30 | 52 | 15.9 | | |
| | 31 – 40 | 16 | 4.9 | | |
| | 41 – 50 | 10 | 3.1 | 15 | 11.02 |
| Household Size | 1 – 5 | 124 | 38.2 | | |
| | 6 – 10 | 145 | 44.6 | | |
| | 11 – 15 | 45 | 13.8 | | |
| | 16 – 20 | 11 | 3.4 | 7 | 3.8 |
| Size of farm (acres) | 5 & below | 245 | 74.9 | | |
| | 6 – 10 | 18 | 5.5 | | |
| | 11 – 15 | 1 | .3 | | |
| | 16 – 20 | 23 | 7 | | |
| | 21 – 25 | 40 | 12.2 | 6.9 | 8.2 |
| Pineapple Variety | | | | | |
| Sugar loaf | Yes | 325 | 99.4 | | |
| | No | 2 | .6 | | |
| Smooth Cayenne | Yes | 40 | 12.2 | | |
| | No | 287 | 87.8 | | |
| MD2 | Yes | 42 | 12.8 | | |
| | No | 285 | 87.2 | | |

Source: Field survey, Boakye (2019)

The results in Table 3 revealed that most 117 (35.9%) of the farmers were between the ages of 41 and 50 years, 103 (31.6%) were between 31 and 40 years and the rest were either between 61 and 60 years, 61years and above or 30 years and below. The average age of the farmers in the study area was 45

years with a standard deviation of 10.7. This implies the respondents are in their active age and therefore can work to improve the productivity of their farm business which in effect will increase their level of profit. Also, the study found that more than half 241 (73.7%) of the farmers were males whereas majority 301 (92%) were married.

Further, it was found that 67 percent of the farmers in the study area were educated to JHS/Middle school level with only few (1.2%) who have attained tertiary education. This implies that the farmers are able to combine the appropriate inputs to attain the required output given their level of education. Again, the results in Table 3 indicated that most 242 (74%) of the farmers had no occupation other than farming. This makes the farmer more committed to the farm business to be able to maximize output and profit since it is the only source of income.

It was further noted in Table 3 that a vast majority 164 (50.2%) of the farmers have been cultivating pineapple for 10 or less years. The pineapple farmers on the average have been in the pineapple growing business for 15 years. The mean household size and farm size were found to be 7 people per household and 6.9 acres respectively.

From Table 3, almost all the farmers 325 (99.4%) in the study area were planting sugar loaf variety with just a few of the farmers 40 (12.2%) and 42 (12.8%) planting smooth cayenne and MD2 respectively.

Table 4 - *Socioeconomic Characteristics of Pineapple Processors*

| Variable | Categories | f | % | $\bar{X}$ | SD |
|---|---|---|---|---|---|
| Age | 30 & Below | 15 | 22.1 | | |
| | 31 – 40 | 30 | 44.1 | | |
| | 41 – 50 | 19 | 27.9 | | |
| | 51 & Above | 4 | 5.9 | 38 | 3.6 |
| Sex | Female | 68 | 100 | | |
| Marital Status | Single | 16 | 23.5 | | |
| | Married | 38 | 55.9 | | |
| | Divorced | 9 | 13.2 | | |
| | Widowed | 5 | 7.4 | | |
| Level of Education | No formal education | 9 | 13.2 | | |
| | Primary | 34 | 50 | | |
| | JHS/Middle school | 15 | 22.1 | | |
| | SHS/Technical/Vocational | 8 | 11.8 | | |
| | Tertiary | 2 | 2.9 | | |
| Experience (Years) | 5 & Below | 25 | 36.8 | | |
| | 6 – 10 | 22 | 32.4 | | |
| | 11 – 15 | 6 | 8.8 | | |
| | 16 – 20 | 9 | 13.2 | | |
| | 21 & Above | 6 | 8.8 | 9.3 | 7.7 |
| Pineapple Variety | | | | | |
| Sugar loaf | Yes | 68 | 100 | | |
| Smooth Cayenne | Yes | 1 | 1.5 | | |
| | No | 67 | 98.5 | | |
| MD2 | No | 68 | 100 | | |
| Source of Finance | | | | | |
| Self-Financing | Yes | 57 | 83.8 | | |
| | No | 11 | 16.2 | | |
| Family/Friends | Yes | 1 | 1.5 | | |
| | No | 67 | 98.5 | | |

Table 4, continued

| | | | |
|---|---|---|---|
| Bank | Yes | 21 | 30.9 |
| | No | 47 | 69.1 |
| Group/Co-operatives | No | 68 | 100 |

Source: Field survey, Boakye (2019)

Table 4 presents results on the socioeconomic characteristics of the pineapple processors in the study area. The results found that pineapple processors have an average age of 38 years with a standard deviation of 3.6. Also, it was found that most 30 (44.1%) of the processors were between the ages of 31 and 40 years, 19 (27.9%) were between the ages of 41 and 50 years, 15 (22.1%) were either 30 years or below and 4 (5.9%) were 51 years of ages and above. The results further revealed that all the processors in the study area were females while most 38 (55.9%) were married and have attained primary education 34 (50%).

The average years for pineapple processing was 9.3 with a standard deviation of 7.7. Again, Table 4 revealed that most 25 (36.8%) of the pineapple processors have been in business for 5 years or less, 22 (32.4%) have also been in the business for 6 to 10 years while the rest of the processors (30.8%) have been in the pineapple processing business for 11 years or above.

The results in Table 4 further found that all the processors process sugar loaf variety while only 1 (1.5%) process smooth cayenne in addition to sugar loaf but none of the processors was found the have processed the MD2 variety. This was as a result of the fact that the MD2 variety was not readily available

and even if available, the consumers preferred the sugar loaf and smooth cayenne varieties to the MD2 variety.

Finally, it was found that pineapple processors in the study area finance their businesses themselves with just a few of them acquiring funds from family/friends or from the bank.

Table 5 - *Socioeconomic Characteristics of pineapple marketers*

| Variable | Categories | f | % | $\bar{X}$ | SD |
|---|---|---|---|---|---|
| Age | 30 & Above | 35 | 20 | | |
| | 31 – 40 | 60 | 34.3 | | |
| | 41 – 50 | 56 | 32 | | |
| | 51 – 60 | 21 | 12 | | |
| | 61 & Above | 3 | 1.7 | 40 | 9.1 |
| Sex | Female | 175 | 100 | | |
| Marital Status | Single | 22 | 12.6 | | |
| | Married | 121 | 69.1 | | |
| | Divorced | 22 | 12.6 | | |
| | Widowed | 10 | 5.7 | | |
| Level of Education | No formal education | 33 | 18.9 | | |
| | Primary | 38 | 21.7 | | |
| | JHS/Middle school | 84 | 48 | | |
| | SHS/Technical/Vocational | 16 | 9.1 | | |
| | Tertiary | 4 | 2.3 | | |
| Household Size | 1 – 4 | 57 | 32.9 | | |
| | 5 – 8 | 98 | 56.6 | | |
| | 9 – 12 | 18 | 10.4 | 6 | 2.3 |
| Experience (years) | 5 & Below | 52 | 29.7 | | |
| | 6 – 10 | 36 | 20.6 | | |
| | 11 – 15 | 38 | 21.7 | | |
| | 16 – 20 | 21 | 12 | | |
| | 21 – 25 | 14 | 8 | | |
| | 25 & Above | 14 | 8 | 12.5 | 8.5 |
| Pineapple Variety Sugar loaf | Yes | 171 | 97.7 | | |
| | No | 4 | 2.3 | | |

Table 5, continued

| | | | |
|---|---|---|---|
| Smooth Cayenne | No | 175 | 100 |
| MD2 | Yes | 4 | 2.3 |
| | No | 171 | 97.7 |
| Source of Finance | | | |
| Self-Financing | Yes | 81 | 46.3 |
| | No | 94 | 53.7 |
| Family/Friends | Yes | 20 | 11.4 |
| | No | 155 | 88.6 |
| Bank | Yes | 18 | 10.3 |
| | No | 157 | 89.7 |
| Groups/C0-operatives | Yes | 58 | 33.1 |
| | No | 117 | 66.9 |
| NGOs | No | 175 | 100 |

Source: Field survey, Boakye (2019)

The socioeconomic characteristics of pineapple marketers in the study area have been presented in Table 5. The results show that 34.3 percent of the respondents were between the ages of 31 and 40. 32 percent of the marketers had their ages between 41 and 50 years, 20 percent were either 30 years or below, 12 percent were between the ages of 51 and 60 whereas 1.7 percent were 60 years and above. The average age of the pineapple marketers in the study area was 40 years with a standard deviation of 9.1. The study revealed that all of the respondents were females indicating that pineapple selling business in Central Region dominated by women.

The study further revealed that more than half 121 (69.1%) of the respondents were married while 48 percent have acquired JHS/Middle School certificate. The results in Table 5 found that the average household size for the pineapple marketers was 6 persons per household with a standard deviation of

2.3 whiles most 52 (29.7%) of the respondents have been in pineapple marketing business for 5 or less years with an average years of selling pineapple as 12.5 years with a standard deviation of 8.5.

The results in Table 5 showed that sugar loaf and MD2 were the pineapple varieties the marketers in the area sell. It was obvious that the pineapple marketers in the study area do finance their activities through personal savings whereas few of them acquire funds from family/friends, banks and groups/co-operatives.

**Profitability of the major value added activities along the pineapple value chain**

This was meant to explore the profitability of the activities by the major actors along the pineapple value chain. The results from the profitability analysis is presented in table 6 to 16.

Table 6 - *Gross Margin Analysis for Pineapple Farmers*

| Gross Margin | Frequency | Percent |
|---|---|---|
| 0 & Below | 2 | .6 |
| 0.1 – 10000 | 121 | 37 |
| 10001 – 20000 | 138 | 42.2 |
| 20001 – 30000 | 22 | 6.7 |
| 30001 & Above | 44 | 13.5 |
| Total | 327 | 100 |

Source: Field survey, Boakye (2019); Mean = 15,631.; SD = 9543.1

The gross margin analysis in Table 6 shows that the pineapple farmers in the study area produce an average of 14,781 pineapple fruits per an acre of pineapple farm and receives an average gross profit of GHs 15,631. The results

also revealed that most 138 (42.2%) of the farmers receive a profit between 10001 and 20000 Ghana cedis per an acre of pineapple farm where-as only 2 (.6%) are not able to break even and hence makes losses.

It can therefore be concluded that pineapple farming business in the central region of Ghana is profitable with an average profit of GHs 15,631 per acre. The findings agrees to the finding in a study by Balogun et al., (2018) which found that pineapple business is profitable and gives more returns to the farmer than the original investment made in terms of purchased inputs.

A study by Baruwa (2013) on the profitability and constraints of pineapple production in Osun State, Nigeria used the multistage sampling technique in selecting 50 respondents through purposive and random selection found that the gross margin and net profits in Naira (Nigerian currency) were N182 725 and N162 045, respectively and concluded that pineapple production was profitable. The finding also agreed to the finding in a study by Kowornu et al., (2013) on certified organic pineapple producers in the central and eastern regions of Ghana over five (5) years period using the NPV and the IRR approaches where cash flows were discounted to their present values revealed that the NPVs were positive indicating that the production of certified organic pineapple in both regions was financially viable. This was further confirmed by the estimated IRRs in both regions which were higher than the cost of capital and hence financially viable.

Further, a study on the organic pineapple production in Ghana for smallholder farmers showed that organic production is more profitable for smallholders than conventional production and farmers collect a fair share of the price premium on the retail level (Yeboah et al., 2016).

Table 7 – *Gross Margin Analysis for Pineapple Processors*

| Gross Margin | Frequency | Percent |
|---|---|---|
| 0 & Below | 22 | 32.4 |
| 0.1 - 10000 | - | - |
| 10001 – 20000 | 7 | 10.3 |
| 20001 – 30000 | 17 | 25 |
| 30001 – 40000 | 5 | 7.4 |
| 40001 & Above | 17 | 25 |
| Total | 68 | 100 |

Source: Field survey, Boakye (2019); Mean = 15,681.3; SD = 36,559.7

The results in Table 7 revealed that the pineapple processor after processing on the average 14781 pineapple fruits receives an average profit of GHs 15,681.3. The study further found that 22 out of 68 pineapple processors either were operating at the break-even point or were making losses. This notwithstanding, 46 out of the 68 pineapple processors were making profits of at least 10,001 Ghana cedis after they have processed on an average 14781 pineapple fruits. According to the processors, the losses were incurred based on the use of poor quality raw material and higher costs involved in transporting them.

The findings confirm the assertion made in a study by Asante & Kuwornu (2014) which sought to compare the profitability of pineapple-mango blend juice and pineapple fruit juice in Ghana. The study identified that pineapple juice processing has a BCR of 1.03, which means that going into the pineapple juice processing is profitable. The value of the NPV (GHS 11,728.00) and IRR (23%) further confirmed that pineapple juice processing is profitable

and that was because the NPV was positive and the IRR was greater than the discounted factor (21%).

Table 8 - *Gross Margin Analysis for Pineapple Marketers*

| Gross Margin | Frequency | Percent |
|---|---|---|
| 0 & Below | 109 | 62.3 |
| 0.1 – 10000 | 36 | 20.6 |
| 10001 – 20000 | 19 | 10.9 |
| 20001 – 30000 | 5 | 2.9 |
| 50001 & Above | 6 | 3.4 |
| Total | 175 | 100 |

Source: Field survey, Boakye (2019); Mean = -134.3; SD = 8,218.8

The results of the gross margin analysis for the pineapple marketers have been presented in Table 8. The results found that more than half 109 (62.3%) of the marketers are either breaking even or making losses. 36 (20.6%) receiving between GHs 1 and GHs 10,000 and less than 20 percent of the marketers receives a profit of GHs 10,001 or above. It was shown that on the average the pineapple marketer after selling an average of 14781 fruits makes a loss of GHs 134.3.

The study therefore concludes that pineapple marketing business is not profitable especially the marketing of the fresh fruits. The revelation in the study was not surprising because the study found fruit perishability, poor pricing of pineapple and unfavourable weather conditions as the major constraints facing the pineapple marketers. The findings agree with the finding in a study by Das et al., (2016) which found that pineapple production is remunerative but the

marketing of pineapple in Ghana is done wrongly which lowers the marketers share of the profits.

On the contrary, a study carried out by Abbey (2005) on the Profitability and Risk Analysis of Ghana's Pineapple marketing (exports) indicated that production and marketing of pineapple is a profitable business particularly to the marketer/exporter who buys from out-growers and therefore do not bear the risks involved in farming pineapple.

**Test for Normality**

Table 9 - *Shapiro-Wilk Normality Test for the Profit Share of the Major Actors along the Pineapple Value Chain*

| Actors | Statistic | df | P – Value |
|---|---|---|---|
| Farmers | .896 | 327 | .000 |
| Processors | .753 | 68 | .000 |
| Parketers | .768 | 175 | .000 |

Source: Field survey, Boakye (2019)

The Shapiro-Wilk test is a formal test for normality. The test is done based on the null hypothesis that the data is normal. For a given data to be normal, the p-values are expected to be larger than .05 (Acquah, 2013). On this premise, it can be concluded that the data on the profit share of the actors does not follow the normal distribution assumption and hence cannot be used for any parametric test. So therefore, instead of using the Analysis of Variance (ANOVA) technique to compare the actors' share of the profits, the Kruskal-Wallis test was used.

According to Acquah (2013), the Shapiro-Wilk test can be used together with the normal Q-Q plots and the histograms. The normal Q-Q plots and the histograms for the test have been presented in the appendices (see Appendix D).

**Difference in the share of profit among the major actors along the pineapple value chain.**

The expectations from this hypothesis was to examine the differences if there exist any in the profit share of the actors. The results from the analysis have been presented below.

Table 10 - *Kruskal-Wallis test to Compare the profit share of the Major Actors along the Pineapple Value Chain*

| Actors | N | Median (%) | Mean Rank |
|---|---|---|---|
| Farmers | 327 | 87.5 | 329.65 |
| Processors | 68 | 77.1 | 337.05 |
| Marketers | 175 | 4.4 | 182.97 |
| | Test Statistics | | |
| Kruskal Wallis H. | | 100.283 | |
| Df | | 2 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

The results in Table 10 showed there is a significant difference in the profit shares of the actors (farmers, $n = 327$: processors, $n = 68$: marketers, $n = 175$), Kruskal-Wallis H ($2, n = 570$) = 100.28, $p < .05$. The farmers had a higher median score of 87.5% than the processors and the marketers who recorded 77.1% and 4.4% respectively.

**Post-hoc tests and effect size**

Since the study have obtained a statistically significant difference for the Kruskal-Wallis test, there is the need to know which of the actors are statistically different from one another. To find out this, the Mann-Whitney *U* test between groups is required. However, to control for type 1 errors, it was necessary to apply the Bonferroni adjustment to the alpha values since each actor was compared with one another (farmers with processors, farmers with marketers and processors with marketers).

The Bonferroni adjustment involves dividing the alpha level of .05 by the number of tests to be conducted and use the revised alpha level as the criteria for determining significance (Pallant, 2005). This meant a stricter alpha level of .05/3 = .017. Since the effect size statistic is not given, the z statistic reported is used to compute an approximate value of *r*.

$$r = \frac{z}{\sqrt{n}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.1)$$

Where: N is the total number of cases. The study employed Cohen (1988) criteria of .1 = small effect, .3 = medium effect and .5 = large effect.

Table 11 - *Mann-Whitney U Test to Compare the profit share of Farmers and Processors*

| Actors | N | Median (%) | Mean Rank |
|---|---|---|---|
| Farmers | 327 | 87.5 | 196.36 |
| Processors | 68 | 77.1 | 205.9 |
| Test Statistics | | | |
| Mann-Whitney U. | | 10580.5 | |
| Z | | -.650 | |
| R | | .03 | |
| P – Value | | .516 | |

Source: Field survey, Boakye (2019)

The results in Table 11 showed that there is no significant difference in the profit shares of the farmers and the processors. The study had $U = 10580.5$, $z = -.650$, $r = .03$ and $p = .516$. An $r$ of .03 means that there is a small effect in the difference though not significant. The farmers recorded a larger median of 87.5% whereas the processors recorded the least median of 77.1%.

Table 12 - *Mann-Whitney U Test to Compare the profit Share of Farmers and Marketers*

| Actors | N | Median (%) | Mean Rank |
|---|---|---|---|
| Farmers | 327 | 87.5 | 297.29 |
| Marketers | 175 | 4.4 | 165.93 |
| Test Statistics | | | |
| Mann-Whitney U. | | 13638 | |
| Z | | -9.834 | |
| R | | .44 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

The Mann-Whitney U test found that there is statistically significant difference in the profit share of the farmers and the marketers with $U = 13638$, $z = -9.834$, $r = .44$ and $p = .000$. From Table 12, the farmers were known to have a larger median (87.5%) than the processors (4.4%).

Table 13 - *Mann-Whitney U Test to Compare the Profit share of processors and Marketers*

| Actors | N | Median (%) | Mean Rank |
|---|---|---|---|
| Processors | 68 | 77.1 | 165.04 |
| Marketers | 175 | 4.4 | 105.04 |
| Test Statistics | | | |
| Mann-Whitney U. | | 2982 | |
| Z | | -6.034 | |
| R | | .39 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

The results in Table 13 indicated that there is a significant difference in the profit share of the processors and the marketers with $U = 2982$, $z = -6.034$, $r = .39$ and $p = .000$. According to Cohen (1988), the magnitude of the difference is large ($r = .39$). From the results, the processors had a greater median (77.1%) compared to that of the marketers (4.4%).

The study revealed that there was a statistically significant difference in the profit shares of the major actors (farmers, processors and marketers) along the pineapple value chain. There was the need to know which of the actors was statistically different from one another using the Mann-Whitney U test. The test revealed that the profit of the marketers was significantly different from that of the farmers and the processors. The finding contradicts the finding in a study by Kumi (2017) which identified farmers and marketers as the main actors along the tomato value chain. The study further showed that, the activities of these actors are profitable but the marketers (Distributors, wholesalers and retailers) receive the greater share of the profit. He further indicated that among the marketers, the retailer of the fresh tomato earned the highest profit of GHS 4.50 on every 5kg of fresh tomatoes sold.

A study by Das et al., (2016) on the marketing systems and value addition of pineapple found farmers, processors and marketers as the major actors along the pineapple value chain. The study also found the activities of these actors to be profitable but the marketer receives the greatest portion of the chain profit.

Owusu-Adjei et al., (2017) carried out a study on the value chain of groundnut in Ghana. Through mapping, value chain actors were identified to be primary producers (farmers), distributors, processors and retailers of output.

Costs and returns estimates indicate that, for every liter of groundnut oil and kilogram of paste produced along the oil and paste chain respectively, the farmer benefits most when he or she sells groundnut in a shelled form. This is followed by the distributor, the retailer of processed output and finally the processor. On the other hand, when the farmer sells groundnut in an unshelled form, the distributor benefits most from both the oil and the paste chain with 51% increase in profit.

Table 14 - *Cobb-Douglas Function to Estimate the Effect of Inputs on Gross Profit of Pineapple Farmers*

| Variable | Coefficients | Std. Err. | t | P-Value |
|---|---|---|---|---|
| Constants | -1.499 | .445 | -3.369 | .001 |
| Revenue | 1.815 | .062 | 29.237 | .000 |
| Cost of labour | -.098 | .059 | -1.651 | .100 |
| Cost of agro-chemicals | -.094 | .105 | -.904 | .367 |
| Capital | -.161 | .049 | -3.263 | .001 |
| Cost of planting materials | -.268 | .061 | -4.385 | .000 |
| Model Summary | | | | |
| R-Square | .75 | | | |
| F-Stats | 196.4 | | | |
| P-Value (F-Stats) | .000 | | | |

Source: Field survey, Boakye (2019)

The Results in Table 14 reveals that the model was statistically significant with an f-statistic of 196.4 and P = .000. This implies all the independent variables (revenue, cost of labour, cost of agro-chemicals, capital and cost of planting materials) in the model significantly influence the dependent variable (profit). Also, Table 14 shows an r-Square value of .75, which indicates that about 75% of the variations in the profit received by the

pineapple farmers is caused by variations in revenue, cost of labour, cost of agro-chemicals, capital and cost of planting materials.

The results showed that cost of labour and cost of agro-chemicals used on the farms do not significantly influence the profit received by the farmer. Also, the results reveals that revenue from the pineapple farm was statistically significant with a coefficient of 1.815 and *t* of 29.237. This indicates that a percentage change in the revenue from the farm will change the profit received by the farmer by 1.82 in the same direction.

The coefficient of -.161 and $t$ = -3.263 of capital was statistically significant at 0.05 significance level. Specifically, a 1% change for capital employed causes profit to change by .16 in opposite direction.

The results further suggests that the cost of planting materials (suckers) used at the farms negatively influence the amount of profit received by the farmer. Thus, a percentage increase in the amount of planting materials used will decrease the profit of the farmer by .27.

From the results in Table 14, it can be concluded that farm revenue, capital inputs and planting materials (suckers) influence the profit of the farmer. These empirical finding confirms the findings by Onoja et al., (2012) which assessed the profitability of cocoa farms in Nigeria's largest cocoa producing state. The results showed that cocoa production is profitable with mean profit of US$10342.93. The determinants were labour, capital, seedlings planted and household size.

The finding also disagrees with Olujenyo (2008) who identified that farming was profitable with gross margin and net returns of N2,637.80 and N2,141.00 respectively. The study further revealed that farm operations was in

stage 2 of production with RTS of .62. The results further showed that age, education, labour and cost of non-labour inputs were positively related to profit while farm size and years of experience carried negative signs. However, only labour input has significant influence on profit.

Table 15 - *Cobb-Douglas Function to Estimate the Effect of Inputs on Gross Profit of Pineapple processors*

| Variable | Coefficient | Std. Err. | t | P-Value |
|---|---|---|---|---|
| Constant | 2.826 | .560 | 5.048 | .000 |
| Revenue | .266 | .195 | 1.362 | .178 |
| Cost of labour | -.268 | .219 | -1.225 | .225 |
| Capital | .616 | .254 | 2.427 | .018 |
| Cost of pineapple fruits | .531 | .185 | 2.864 | .006 |
| Cost of Packaging materials | -.434 | .161 | -2.699 | .009 |
| Model Summary | | | | |
| R-Square | .33 | | | |
| F-Stats | 6.003 | | | |
| P-Value (F-Stats) | .000 | | | |

Source: Field survey, Boakye (2019)

Table 15 reveals that the model was statistically significant with $f$ = 6.003 and $p$ = .000. This indicates that the profit of the pineapple processor is influenced by revenue received from the activity, cost of labour employed, capital, cost of pineapple fruits used and the cost of packaging materials used. The results also reveals that the r-square was .33, which implies about 33% of the variations in the processor profit is caused by variations in revenue, cost of labour, capital, cost of pineapple fruits and cost of packaging materials.

From the results in Table 15, it was found that revenue and cost of labour had no significant effect on profit although revenue relates positively to profit.

Also, capital was found to be influencing profit positively with a coefficient of .616 and $t = 2.427$. This indicates that a percentage increase in the amount of capital inputs employed will increase profit by .62.

Further, cost of pineapple fruits used was found to influence the profit of the processor. Thus, cost of the fruits significantly and positively influence profit with the coefficient of .531 and $t$ of 2.864. The results also found that cost of packaging materials used significantly influenced profit. Thus, a percentage change in the cost of packaging materials will cause profit to change by .43 in opposite direction.

The study therefore concludes that the portability of the pineapple processor is influenced by capital, cost of pineapple fruits (raw materials) and cost of packaging materils. The finding agrees to the finding in a study by Adekanye et al., (2013) who researched gari processing determinants among female processors in Kwara State, Nigeria and found that age and capital were the major determinants of profit in the research area.

Similarly, a study by Ehinmowo et al., (2015) revealed that cassava processing business was profitable. The outcome of the regression model stated that the variables that determined profitability in the study area were education, year of experience, access to extension facilities, family size, price of raw materials and kinds of cassava bought.

Table 16 - *Cobb-Douglas Function to Estimate the Effect of Inputs on Gross Profit of Pineapple Marketers*

| Variable | Coefficient | Std. Err. | t | P-Value |
|---|---|---|---|---|
| Constant | .167 | .185 | .903 | .368 |
| Revenue | .809 | .049 | 16.571 | .000 |
| Transportation | -.294 | .083 | -3.538 | .001 |
| Cost of loading and off-loading | -.205 | .098 | -2.078 | .039 |
| Cost of packaging | .165 | .143 | 1.150 | .252 |
| Cost of storage | .026 | .081 | .319 | .750 |
| Model Summary | | | | |
| R-Square | .70 | | | |
| F-Stats | 79.216 | | | |
| P-Value (F-Stats) | .000 | | | |

Source: Field survey, Boakye (2019)

The results in Table 16 reveals that the model was statistically significant with $f = 79.216$ and $p = .000$. This shows that the pineapple marketer's profit is affected by the income earned, cost of transportation, cost of loading and off-loading, cost of storage and cost of packaging. The results also reveals that the r-square was .70, which implies about 70% of the variations in the marketer profit is caused by variations in revenue, cost of transportation, cost of loading and off-loading, cost of packaging and cost of storage.

It has been discovered from the results in Table 16 that cost of packaging and cost of storage have no important impact on profit, although both have a positive relationship with profit. Also, revenue was found to be influencing profit positively with a coefficient of .809 and $t = 16.571$. This indicates that a percentage increase in the amount of revenue will increase profit by .81.

Further, cost of transportation was found to significantly influence the profit of the marketer. Thus, cost of transportation negatively influence profit with the coefficient of -.294 and *t* of -3.538. The results also found that cost of loading and off-loading of the fruits significantly influenced profit. Thus, a percentage change in cost of loading and off-loading of the fruits will cause profit to change by .21 in opposite direction.

The empirical study revealed that revenue, cost of transportation and cost of loading and off-loading significantly influence the profit of the marketer. The finding accords the finding by Arowolo et al., (2016) which discovered that the marketing of cocoa beans in the study area is a lucrative venture with a gross margin of $137,719.27 (US$ 885.51) per month and a marketing margin of N40,600 (US$ 261.94). The result of the analysis of the OLS regression also disclosed that transportation costs, communication costs, quantity of cocoa traded and credit union affiliation are the major determinants of the profit margin accruing to the marketer of cocoa beans.

The study by Wongnaa et al., (2014) which discovered that wholesalers had a 99.7 percent bigger margin, while retailers had a 75.4 percent margin. Labor cost, purchase price, transport cost and selling price were determinants of marketing profit through all the estimated regression model was confirmed by the findings from the current study.

**Efficiency of the major actors along the pineapple value chain**

The results for the technical efficiency of the pineapple farmers was presented in Table 17. the results revealed that only 30 (9.18%) of the farmers operates with the overall technical efficiency of .90 and above under the assumption of constant returns to scale (CRS) whiles about 90.82 percent of the

farmers were technically inefficient with respect to the allocation of inputs at the farm. The mean efficiency was .51 with the overall technical efficiency scores ranging from .079 to 1.00. The results in Table 17 found that the 90.82% of the farmers who were not operating at the maximum level of efficiency could reduce their usage of inputs by 49% and still maintain the same level of production as achieved by the 9.18% technically efficient farmers.

Table 17 - *Technical and Scale Efficiency of pineapple Farmers*

| | TE – CRS | | TE – VRS | | Scale | |
|---|---|---|---|---|---|---|
| Efficiency Range | F | % | F | % | F | % |
| 0 < E < 0.1 | 2 | .61 | - | - | - | - |
| 0.1 < E < 0.2 | 9 | 2.75 | - | - | 2 | .61 |
| 0.2 < E < 0.3 | 79 | 24.16 | 2 | .61 | 5 | 1.53 |
| 0.3 < E < 0.4 | 38 | 11.62 | 13 | 3.98 | 5 | 1.53 |
| 0.4 < E < 0.5 | 31 | 9.48 | 67 | 20.49 | 13 | 3.98 |
| 0.5 < E < 0.6 | 85 | 25.99 | 95 | 29.05 | 36 | 11.01 |
| 0.6 < E < 0.7 | 13 | 3.98 | 53 | 16.21 | 27 | 8.27 |
| 0.7 < E < 0.8 | 31 | 9.48 | 22 | 6.73 | 79 | 24.16 |
| 0.8 < E < 0.9 | 9 | 2.75 | 13 | 3.98 | 53 | 16.21 |
| 0.9 < E < 1 | 25 | 7.65 | 8 | 2.45 | 100 | 30.6 |
| E ==1 | 5 | 1.53 | 54 | 16.51 | 7 | 2.14 |

| Summary of TE – CRS | | | | | |
|---|---|---|---|---|---|
| | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| Min. | .293 | .530 | .505 | .624 | 1.000 |
| 0.079 | | | | | |
| Summary of TE – VRS | | | | | |
| | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| Min. | .503 | .584 | .641 | .766 | 1.000 |
| 0.288 | | | | | |
| Summary of scale eff. | | | | | |
| | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
| Min. | .687 | .789 | .772 | .915 | 1.000 |
| 0.115 | | | | | |

Source: Field survey, Boakye (2019)

By using the variable returns to scale model, the pure technical efficiency ranged from .29 to 1.00 with mean efficiency score of .64. Relaxation of the assumption of constant returns to use the convexity assumption of variable returns to scale revealed that technical efficiency score more than 90 percent increased from 9.18% to 20% with the mean technical efficiency increasing from .51 to .64. This is because the pure technical efficiency calculated is devoid of scale effects and the ratio of technical efficiency under constant returns to the technical efficiency under variable returns is called scale efficiency.

From Table 17 about 32.74% of the farmers were found with scale efficiency of more than 90 percent. The scale efficiency scores for the farmers ranged from .12 to 1.00 with an average of .77. The above results show that the farmers who were scale inefficient (67.26%) could increase their scale efficiency by 23% in other to operate in optimal scale under the current technology. By operating in an optimal scale, the farmers would be able to increase productivity and incomes from their farm.

The finding implies most of the farmers in the study area are technically inefficient with mean technical efficiency (CRS), pure efficiency and scale efficiency levels of .51, .64 and .77 respectively. The findings agrees to the finding by Balogun et al., (2018) which found that farms were operating inefficiently with efficiency score of 0.603.

Also, a study by Lubis et al., (2014) found that farmers were inefficient in the pineapple production with mean technical, allocative and economic efficiency level of 70.1%, 34.1% and 24.1%, respectively.

On contrary, the finding disagree to the finding by Nchare (2007) who studied the factors affecting the technical efficiency of Arabica coffee producers in Cameroon using the translog stochastic production frontier function found that technical efficiency index of the 140 farmers during the 2004 crop year was estimated to be 0.896.

Table 18 - *Technical and Scale Efficiency of pineapple processors*

| Efficiency Range | TE – CRS | | TE – VRS | | Scale | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| 0 < E < 0.1 | 7 | 10.3 | - | - | 3 | 4.4 |
| 0.1 < E < 0.2 | 4 | 5.9 | - | - | - | - |
| 0.2 < E < 0.3 | 16 | 23.5 | - | - | 8 | 11.8 |
| 0.3 < E < 0.4 | 10 | 14.7 | 8 | 11.8 | 6 | 8.8 |
| 0.4 < E < 0.5 | 9 | 13.2 | 3 | 4.4 | 18 | 26.8 |
| 0.5 < E < 0.6 | 6 | 8.8 | 9 | 13.2 | 7 | 10.3 |
| 0.6 < E < 0.7 | 3 | 4.4 | 12 | 17.6 | 1 | 1.5 |
| 0.7 < E < 0.8 | 2 | 2.9 | 11 | 16.2 | 4 | 5.9 |
| 0.8 < E < 0.9 | - | - | 2 | 2.9 | - | - |
| 0.9 < E < 1 | 4 | 4.9 | 8 | 11.8 | 14 | 20.6 |
| E ==1 | 7 | 10.3 | 15 | 22.1 | 7 | 10.3 |

| Summary of T – CRS | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|---|---|---|---|---|---|
| Min. | .238 | .379 | .450 | .592 | 1.000 |
| 0.036 | | | | | |
| **Summary of TE – VRS** | **1st Qu.** | **Median** | **Mean** | **3rd Qu.** | **Max.** |
| Min. | .535 | .727 | .727 | .972 | 1.000 |
| 0.306 | | | | | |
| **Summary of TE – CRS** | **1st Qu.** | **Median** | **Mean** | **3rd Qu.** | **Max.** |
| Min. | .415 | .477 | .597 | .939 | 1.000 |
| 0.052 | | | | | |

Source: Field survey, Boakye (2019)

The technical efficiency of the pineapple processors was presented in Table 18, the results revealed that only 13 (15.1%) of the processors operates

with the overall technical efficiency of .90 and above under the assumption of constant returns to scale (CRS) whiles about 84.9 percent of the processors were technically inefficient with respect to the allocation of inputs. The mean efficiency was .45 with the overall technical efficiency scores ranging from .036 to 1.00. The results further revealed that the 84.9% of the processors who were not operating at the maximum level of efficiency could reduce the usage of inputs by 55% and still maintain the same level of production as achieved by the 15.1% processors who are technically efficient.

Also, by relaxing the assumption of constant returns to scale, the pure technical efficiency ranged from .31 to 1.00 with mean efficiency score of .73. Using the convexity assumption of variable returns to scale the study revealed that technical efficiency score more than 90 percent increased from 15.1% to 33.9% with the mean technical efficiency increasing from .45 to .73. This is because the pure technical efficiency calculated is devoid of scale effects. The ratio of technical efficiency under constant returns to technical efficiency under variable returns is the scale efficiency.

From Table 18 about 30.9% of the processors were found with scale efficiency of more than 90 percent. The scale efficiency scores for the processors ranged from .42 to 1.00 with an average of .60. The above results found that the processors who were scale inefficient (69.1%) could increase their scale efficiency by 40% in other to operate in optimal scale under the current technology.

The finding shows that only few of the pineapple processors in the study area are technically efficient. The findings are in line with the finding in a study by Oktari et al., (2016) which employed the Data Envelopment Analysis (DEA)

method with Constant Return to Scale (CRS) assumption through input oriented approach was used to know the levels of the pineapple chips producers' relative efficiency. The study revealed that that most of the pineapple chips producers are inefficient (13 out of 21) or 61.90%, while only 8 out of 21 or 38.10% are efficient.

A study by Kapya (2016) also found that there are sufficient growth opportunities in Zambia's agro-processing industry, but the industry is highly inefficient. The average technical efficiency was 42.5 percent while scale efficiency was 81.7 percent.

Table 19 - *Technical and Scale Efficiency of pineapple marketers*

| Efficiency Range | TE – CRS | | TE – VRS | | Scale | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| 0 < E < 0.1 | 107 | 61.14 | 2 | 1.1 | 55 | 31.4 |
| 0.1 < E < 0.2 | 31 | 17.71 | 24 | 13.7 | 15 | 8.6 |
| 0.2 < E < 0.3 | 20 | 11.43 | 59 | 33.7 | 17 | 9.7 |
| 0.3 < E < 0.4 | 4 | 2.29 | 35 | 20 | 31 | 17.7 |
| 0.4 < E < 0.5 | 3 | 1.71 | 16 | 9.1 | 20 | 11.4 |
| 0.5 < E < 0.6 | 5 | 2.86 | 11 | 6.3 | 11 | 6.3 |
| 0.6 < E < 0.7 | 1 | .57 | 6 | 3.4 | 16 | 9.1 |
| 0.7 < E < 0.8 | - | - | 8 | 4.6 | - | - |
| 0.8 < E < 0.9 | - | - | 3 | 1.7 | 4 | 2.3 |
| 0.9 < E < 1 | - | - | - | - | 2 | 1.1 |
| E ==1 | 4 | 2.29 | 11 | 6.3 | 4 | 2.3 |
| Summary of TE – CRS | 1st Qu. | Median | Mean | 3rd Qu. | Max. | |
| Min. 0.003 | .026 | .068 | .134 | .176 | 1.000 | |
| Summary of TE – VRS | 1st Qu. | Median | Mean | 3rd Qu. | Max. | |
| Min. 0.093 | .250 | .313 | .385 | .433 | 1.000 | |
| Summary of scale eff. | 1st Qu. | Median | Mean | 3rd Qu. | Max. | |
| Min. 0.012 | .093 | .311 | .319 | .424 | 1.000 | |

Source: Field survey, Boakye (2019)

The results in Table 19 revealed that only 4 (2.29%) of the marketers operates with the overall technical efficiency of .90 and above under the constant returns to scale assumption (CRS) whiles about 97.71 percent of the marketers were technically inefficient with respect to input allocation. The mean efficiency for the marketers was .13 with the overall technical efficiency scores ranging from .003 to 1.00. The results in Table 19 found that the 97.71% of the marketers who were not operating at the maximum level of efficiency could reduce their usage of inputs by 87% and still maintain the same level of production as achieved by the 2.29% marketers who are technically efficient.

The pure technical efficiency as computed using the assumption of variable returns to scale (CRS) ranged from .09 to 1.00 with mean efficiency score of .39. By relaxing the assumption of constant returns to use the convexity assumption of variable returns to scale it was found that technical efficiency score more than 90 percent increased from 2.29% to 6.3% whereas mean technical efficiency increased from .13 to .39. This is because the computed pure technical efficiency is without scale effects and the ratio of technical efficiency with constant returns to technical efficiency with variable returns is called scale efficiency.

From Table 19, about 3.4% of the marketers were found with scale efficiency of more than 90 percent. The scale efficiency scores for the marketers ranged from .01 to 1.00 with an average of .32. The above results show that the marketers who were scale inefficient (96.6%) could increase their scale efficiency by 68% in other to operate in optimal scale under the current technology. By operating in an optimal scale, the marketers would be able to increase productivity and incomes from their activity.

The results revealed that pineapple marketers were technically inefficient with mean technical, pure and scale efficiency scores of .13, .39 and .32 respectively. The finding in the study agrees to the finding by Assaf et al., (2011) which found that retail stores in the study area were technically inefficient. The study further revealed that longer years in business, stronger geographical presence, and lower price offerings. Vertical integration, on the other hand, is negatively related to efficiency.

On the contrary, the study by El-Megharbel (2010) on the efficiency of wholesale and retail distribution services in Egypt used the Data Envelopment Analysis (DEA) to estimate the technical efficiency of retailers and wholesalers. The study found that the retailers and Wholesalers in Egypt were technically efficient. Similarly, a study by Sellers-Rubio and Más-Ruiz (2009) found that retailers of the food industry were technically efficient with a mean technical efficiency of .95.

**Kruskal-Wallis test to compare the Efficiencies of the Major Actors**

The Kruskal-Wallis test is the non-parametric alternative to a one-way between-group analysis of variance. It allows for the comparison of a continuous variable across two or more groups. The test was employed in the study following the fact that the data was extracted from a test conducted using a non-parametric technique (Data Envelopment Analysis [DEA]) and hence the decision to use the Kruskal Wallis test to compare the efficiencies of the actors.

Table 20 - *Kruskal-Wallis test to compare the Efficiencies of the Major Actors along the Pineapple Value Chain*

| Actors | N | Median | Mean Rank |
|---|---|---|---|
| Farmers | 327 | .530 | 366.32 |
| Processors | 68 | .379 | 323.40 |
| Marketers | 175 | .073 | 119.75 |
| Test Statistics | | | |
| Kruskal Wallis H. | | 259.833 | |
| Df | | 2 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

The results in Table 20 showed a statistically significant difference in the efficiency scores of the actors (farmers, $n$ = 327: processors, $n$ = 68: marketers, $n$ = 175), Kruskal-Wallis H (2, $n$ = 570) = 259.83, $p < .05$. The farmers recorded a higher median score (.530) than the processors and the marketers who recorded .379 and .073 respectively.

**Post-hoc tests and effect size**

Since the study have obtained a statistically significant difference for the Kruskal-Wallis test, there is the need to know which of the actors are statistically different from one another. To find out this, the Mann-Whitney $U$ test between groups is required. But to control for type 1 errors, it was necessary to apply the Bonferroni adjustment to the alpha values since each actor was compared with one another (farmers with processors, farmers with marketers and processors with marketers).

The Bonferroni adjustment involves dividing the alpha level of .05 by the number of tests to be conducted and use the revised alpha level as the criteria

for determining significance (Pallant, 2005). This meant a stricter alpha level of .05/3 = .017. Since the effect size statistic is not given, the *z* statistic reported is used to compute an approximate value of *r*.

$$r = \frac{z}{\sqrt{n}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4.1)$$

Where: N is the total number of cases. The study employed Cohen (1988) criteria of .1 = small effect, .3 = medium effect and .5 = large effect.

Table 21- *Mann-Whitney U Test to Compare the Efficiencies of Farmers and Processors*

| Actors | N | Median | Mean Rank |
|---|---|---|---|
| Farmers | 327 | .530 | 203.53 |
| Processors | 68 | .379 | 171.4 |
| Test Statistics | | | |
| Mann-Whitney U. | | 9309.5 | |
| Z | | -2.114 | |
| R | | .11 | |
| P – Value | | .035 | |

Source: Field survey, Boakye (2019)

The results in Table 21 revealed that there is no significant difference in the efficiency scores of the farmers (*md* = .530, *n* = 327) and processors (*md* = .379, *n* = 68), *U* = 9309.5, *z* = -2.114, *r* = .11 and *p* > .017. The magnitude of the difference is small based on the criteria set out by Cohen (1988).

The Mann-Whitney U test found that there is a statistically significant difference in the efficiency scores of the farmers and the marketers with U =

3992, z = -15.906, r = .71 and p = .000. According to Cohen (1988), the magnitude of the difference is large.

Table 22 - *Mann-Whitney U Test to Compare the Efficiencies of Farmers and Marketers*

| Actors | N | Median | Mean Rank |
|---|---|---|---|
| Farmers | 327 | .530 | 326.79 |
| Marketers | 175 | .073 | 110.81 |
| Test Statistics | | | |
| Mann-Whitney U. | | 3992 | |
| Z | | -15.906 | |
| R | | .71 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

Table 23 - *Mann-Whitney U Test to Compare the Efficiencies of Processors and Marketers*

| Actors | N | Median | Mean Rank |
|---|---|---|---|
| Processors | 68 | .379 | 186.5 |
| Marketers | 175 | .073 | 96.9 |
| Test Statistics | | | |
| Mann-Whitney U. | | 1564 | |
| Z | | -8.918 | |
| R | | .57 | |
| P – Value | | .000 | |

Source: Field survey, Boakye (2019)

The Mann-Whitney U test in Table 23 found that there is a significant difference in the efficiency scores of the processors and the marketers with $U$ = 1564, $z$ = -8.918, $r$ = .57 and $p$ = .000. According to the assertion made by Cohen (1988), the magnitude of the difference is large. From the results, the processors had a greater median (.379) compared to that of the marketers (.073).

The study revealed that there was statistically significant differences in the efficiency scores of the major actors (farmers, processors and marketers) along the pineapple value chain. There was therefore the need to know which of the actors were significantly different from one another using the Mann-Whitney U test. The test revealed that the efficiency scores of the marketers were significantly different from that of the farmers and the processors. The finding accords the findings in a study by Kathiravan et al., (2018) which identified that technical inefficiency was less in irrigated farms than in dry farms. Similarly, the scale inefficiency was found high in dry farms than in irrigated farms. The study also found that there were differences in mean technical and scale efficiency among dry and irrigated farms in the study area.

Njikam (2003) estimated the pre and post trade reform stochastic frontier production functions for seven Cameroonian industrial sub-sectors. The study found the mean technical efficiency of the firms in the pre-trade reform as 83.78 and that of the firms in the post-trade reform to be 81.87. The study concluded that the firm-specific technical efficiencies in the post-trade reform period was significantly different from that of the pre-trade reform period.

Also, a study by Bhasin and Akpalu (2001) on the technical efficiency of women entrepreneurs engaged in hairdressing and male wood processors of Cape Coast, Ghana, found that the efficiency of the women entrepreneurs was significantly different from the efficiency of the male wood processors.

**The constraints facing the major actors along the pineapple value chain**

Under this section, the respondents were made to respond to a number of items on a 5-point Likert-type scale. The results from the responses have been presented in Tables 24 to 26.

The Kendall's coefficient of concordance in Table 24 revealed that there is about 26% agreement among the 327 farmers in ranking the constraints facing pineapple production. It can therefore be concluded that there exist a considerable but significant agreement among the farmers with regards to the ranking of the constraints faced by pineapple farmers. Thus, it is evident that at least one of the constraints is ranked significantly higher than the other.

From Table 24 the major constraints facing pineapple farmers in the study area were lack of credit facilities, high cost of inputs, product quality and poor agronomic practices. Also, the least pressing constraints to the farmers were erratic rainfall pattern, customer taste and preference and the distance to market.

Table 24 - *Constraints Facing Pineapple Farmers*

| Variable | Mean Rank |
|---|---|
| Lack of credit facilities | 3.64 |
| High cost of input | 4.59 |
| Poor agronomic practices | 5.80 |
| Product quality | 5.80 |
| Seasonal price fluctuations | 6.14 |
| Post-harvest handling | 6.68 |
| Pests and diseases | 6.95 |
| Lack of access to current market information | 7.41 |
| Low access to improved variety | 8.07 |
| Low access to extension services | 8.30 |
| Erratic rainfall pattern | 8.59 |
| Customer taste and preference | 9.13 |
| Distance to market | 9.89 |
| **Test Statistics** | |
| N | 327 |
| Kendall's W | .260 |
| Chi-Square | 1020.72 |
| Df | 12 |
| P – Value | .000 |

Source: Field survey, Boakye (2019)

The study therefore concludes that lack of credit facilities (3.64), high cost of inputs (4.59), product quality (5.80) and poor agronomic practices (5.80)

were the major constraints facing the pineapple farmer. The findings are in line with the findings in a study by Jaji et al., (2018) which found credit access, pineapple varieties, distance to the market, cost of input, price of pineapples and extension services as the major constraints to pineapple production. Similarly, a study by Baruwa (2013) identified limited availability of high quality planting materials, high fruit perishability, low fruit prices, low access to credits and plant diseases as the major production and marketing challenges faced by the pineapple producer.

The finding in a study by Adaigho and Okpeke, (2018) which found that lack of improved planting materials, high fruit perishability and low fruit price were the major problems of pineapple farmers contradicts the findings in the current study.

The results in Table 25 reveals that there is about 21% agreement among the 68 pineapple processors in ranking their constraints. Therefore, it can be concluded that there is considerable but substantial agreement between processors regarding the ranking of the constraints faced by pineapple processors. It is therefore obvious that at least one of the constraints is considerably greater than the other.

From Table 25 the major constraints facing pineapple processors in the study area include: lack of raw materials, poor quality raw materials, high transport cost of raw materials and high cost of raw materials. Also, the least constraints facing the processors were lack of access to current market information, inadequate transport infrastructure and limited knowledge on how to process quality products.

Table 25 - *Constraints Facing Pineapple Processors*

| Variable | Mean Rank |
|---|---|
| Lack of raw material | 4.06 |
| Poor quality raw materials | 4.67 |
| High transport cost of raw materials | 5.10 |
| High cost of raw materials | 5.42 |
| Lack of funds to acquire modern equipment | 5.57 |
| Lack of proper packaging materials | 5.69 |
| Lack of entrepreneurial training | 6.09 |
| Limited access to information on export market requirements | 6.58 |
| Lack of access to current market information | 7.25 |
| Inadequate transport infrastructure | 7.30 |
| Limited knowledge on how to process quality products | 8.28 |
| **Test Statistics** | |
| N | 61 |
| Kendall's W | .207 |
| Chi-Square | 126.54 |
| df | 10 |
| P – Value | .000 |

Source: Field survey, Boakye (2019)

The study therefore concludes that the major constraints facing the pineapple processors include: lack of raw materials (4.06), poor quality raw materials (4.67), high transport cost of raw materials (5.10) and high cost of raw materials (5.42). The findings are in line with the assertion made in a study by Adelaja et al., (2000) which found that the area of environmental and other regulation is the most problematic for food processors. Other areas of concern include, in order of importance, taxation and fiscal problems, economic barriers

to development and expansion, high cost of doing business, education, training and labor concerns, communication and public relations, and transportation.

The findings are similar to the findings in a study by Singh et al., (2012) which examined the trends and status of the food processing industry, identifies and discusses constraints/problems slowing down its growth. The study found that there are many promising dynamics which support the potential for growth of this industry, there are still some significant constraints which, if not addressed sooner, can impede the growth prospects of the Food Processing Industry in India.

Table 26 - *Constraints Facing Pineapple Marketers*

| Variable | Mean Rank |
|---|---|
| Fruit perishability | 3.87 |
| Poor pricing of pineapple | 3.97 |
| Unfavourable weather conditions | 4.24 |
| Market trends | 4.27 |
| Poor handling and packaging system | 5.18 |
| Consumer taste and preference | 5.78 |
| Poor storage system | 5.83 |
| Product quality | 5.83 |
| Market channels | 6.03 |
| Test Statistics | |
| N | 175 |
| Kendall's W | .166 |
| Chi-Square | 232.79 |
| df | 8 |
| P – Value | .000 |

Source: Field survey, Boakye (2019)

Results from the Kendall's coefficient of concordance in Table 26 revealed that there is about 16% agreement among the marketers in ranking their constraints. It can therefore be concluded that there exists a significant agreement among the respondents with regards to the ranking of the constraints faced by pineapple marketers. Thus, it is evident that at least one of the constraints is ranked significantly higher than the other.

The results in Table 26 further shows that the major constraints facing pineapple marketers in the study area include: fruit perishability, poor pricing of pineapple and unfavourable weather conditions. However, the least pressing constraints facing marketers of pineapple include product quality and market channels.

The study can therefore conclude that fruit perishability (3.87), poor pricing of pineapple (3.97) and unfavourable weather conditions (4.24) were the major constraints facing the pineapple marketers in the study area. The finding confirms the finding in a study by Adaigho and Okpeke, (2018) which also identified the potentials and problems of pineapple production and marketing in the area. The study found lack of improved planting materials, high fruit perishability and low fruit price as the major problems of pineapple farmers and marketers.

Similarly, Baruwa (2013) also identified high fruit perishability, low fruit prices and low access to credits as the major production and marketing challenges faced by the pineapple producer.

## Sustainability of the activities by the major actors along the pineapple value chain

### Classification of Farmers based on the Sustainability Practices in the Farming Business

The study first estimated the extent of sustainability in the farm household's operations. Sustainability was limited to 0 to 1, in the same way farm sustainability practices rose from 0 to 1. The average sustainability index for the farmers was .62 on a range of .12 to 1. Similarly, the study adopted and modified the sustainability scale (see Appendix E) by Inkoom et al., (2019) and used it as a basis of comparison. The scale was divided into four equal parts where the first quarter (0-.25) was classified as very lowly sustainable, the second quarter (.26-.50) was also labelled lowly sustainable, the third quarter (.51-.75) was labelled highly sustainable and the fourth quarter (.76-1.0) was labelled very highly sustainable. Furthermore, the study used the sustainability index scale as a baseline to rate farming activities as lowly, very low, highly and very highly sustainable.

### Classification of Farmers based on the Computed Sustainability index scores

The cluster analysis was used to classify farm household's agricultural activities based on the calculated sustainability index scores. The results from the cluster analysis have been presented in Table 27

The cluster analysis was done based on the sustainability index scores of the farmers. The farmers were placed in three clusters: cluster 1, cluster 2 and cluster 3 with cluster means .86, .60 and .41 respectively. The distance between the clusters centers was found to be .412. Also, the ANOVA results from the

cluster analysis was statistically significant with an $f$ of 872.67 and $p$ = .000. This implies the mean of one cluster or group (cluster 1) is statistically different from the mean of the other clusters or groups (cluster 2 and 3). The cluster groupings therefore showed that farm households belonging to each cluster exhibit similar characteristics concerning sustainable agricultural practices.

Table 27 - *Classification of Farmers based on their Sustainability Index Scores*

| Clusters | Frequency | Percent | $\bar{X}$ |
|---|---|---|---|
| Cluster 1 | 81 | 24.8 | .86 |
| Cluster 2 | 178 | 54.4 | .60 |
| Cluster 3 | 68 | 20.8 | .41 |
| | ANOVA | | |
| Df | | 324 | |
| F | | 872.67 | |
| P-value | | .000 | |

Source: Field survey, Boakye (2019)

Moreover, more than half (54.4%) of the farmers were in cluster 2, 24.8% of the farmers were in cluster 1 while 20.8% of the farmers were grouped under cluster 3. With reference to the benchmark set for the farmers based on the sustainability scale, indicates that the cluster mean of.41 for cluster 3 suggest the sustainability of the agricultural practices by members in cluster 3 was lowly sustainable. Also, the cluster mean of .60 for cluster 2 compared to the sustainability scale was highly sustainable and the cluster mean of .86 for cluster 1 meant the agricultural activities by the farm households was highly sustainable.

**Classification of Processors based on the Sustainability Practices in the Pineapple Processing Business**

The sustainability index score for the processor was limited to 0 to 1, in the same way, sustainability practices for the processors rose from 0 to 1. The average sustainability index for the processors was .82 on a range of .46 to 1. Similarly, the study adopted and modified the sustainability scale (see Appendix F) by Inkoom et al., (2019) and used it as a benchmark to compare the clusters/groups. The scale was divided into four equal parts where the first quarter (0-.25) was very low-sustainability, the second quarter (.26-.50) was also low-sustainability, the third quarter (.51-.75) was labeled highly sustainable and the fourth quarter (.76-1.0) was very highly sustainable. The sustainability index scale is presented in figure 5 (see Appendix F).

**Classification of Pineapple Processors based on the Computed Sustainability index scores**

Table 28 - *Classification of Processors based on their Sustainability Index Scores*

| Clusters | Frequency | Percent | $\bar{X}$ |
|---|---|---|---|
| Cluster 1 | 56 | 82.4 | .87 |
| Cluster 2 | 12 | 17.6 | .61 |
| | ANOVA | | |
| Df | | 66 | |
| F | | 130.77 | |
| P-value | | .000 | |

Source: Field survey, Boakye (2019)

The cluster analysis for pineapple processors was done based on their sustainability index scores. The processors were put into two main clusters: cluster 1 and cluster 2 with cluster mean .87 and .61 for cluster 1 and 2 respectively. The cluster groupings depict that processors in the same cluster have similar characteristics as far as their sustainable practices were concerned. The results further revealed that the distance between the final cluster centers was .358. Again, the ANOVA results found an $f = 130.77$ and $p = .000$; implying the mean of cluster 1 is statistically different from the mean of cluster 2.

In addition, a vast majority of the processors (82.4%) were in cluster 1 and 17.6 percent were in cluster 2. Referring to the baseline set for processors based sustainability scale, the cluster mean of.61 for cluster 2 shows that the activity of the processors within the group was highly sustainable. Also, the cluster mean of .87 for cluster 1 implies that the practices by pineapple processors in cluster 1 was very highly sustainable.

**Classification of Marketers based on the Sustainability Practices in the Pineapple Marketing Business**

The sustainability index score for the marketers was limited to 0 to 1, in the same way, sustainability practices for the marketers rose from 0 to 1. The average sustainability index for the marketers was .69 on a range of .13 to .93. Similarly, the study adopted and modified the sustainability scale (see Appendix G) by Inkoom et al., (2019) and used it as a benchmark to compare the clusters/groups. The scale was divided into four equal parts where the first quarter (0-.25) was very low-sustainability, the second quarter (.26-.50) was low-sustainability, the third quarter (.51-.75) was labeled highly sustainable and

the fourth quarter (.76-1.0) was very highly sustainable. The sustainability index scale is presented in figure 6 (see Appendix G).

**Classification of Pineapple Marketers based on the Computed Sustainability index scores**

Table 29 - *Classification of Marketers based on their Sustainability Index Scores*

| Clusters | Frequency | Percent | $\bar{X}$ |
|---|---|---|---|
| Cluster 1 | 152 | 86.9 | .74 |
| Cluster 2 | 23 | 13.1 | .38 |
| | ANOVA | | |
| Df | | 173 | |
| F | | 241.83 | |
| P-value | | .000 | |

Source: Field survey, Boakye (2019)

The cluster analysis for the markers was done based on their sustainability index scores. The marketers were grouped under two main clusters: cluster 1 and cluster 2 with cluster means .74 and .38 for cluster 1 and 2 respectively. The cluster groups show that marketers in the same cluster have equivalent attributes in terms of their sustainable practices. In addition, a vast majority of the marketers (86.9%) were in cluster 1 and 13.1 percent were in cluster 2. Referring to the baseline set for the marketers based on the sustainability scale, the cluster mean of.38 for cluster 2 shows that the activity of the marketers within the group was lowly sustainable. Also, the cluster mean of .74 for cluster 1 implies the practices by pineapple marketers in cluster 1 was highly sustainable. The results further revealed that the minimum distance between the final cluster centers was .80. Again, the ANOVA results found an

$f = 241.83$ and $p = .000$; which implies cluster 1 mean is statistically different from the mean cluster 2.

From the sustainability index scores computed for the actors, the activities by the pineapple farmers, marketers and processors were highly sustainable and very highly sustainable with mean sustainability scores of .62, .69 (farmers and marketers) and.82 (processors) respectively.

The studies by Gamboa (2014) and Inkoom et al., (2019) concluded that the activities by the farm households was moderately sustainable.

Also, the study by Akaba (2018) on climate change responses, food security and production sustainability of maize farmers in the Volta Region of Ghana revealed that farmers have positive attitudes towards sustainable agriculture.

**Chapter Summary**

The empirical study revealed that most of the pineapple farmers in the study area were males with an average age of 45 years and have attained JHS/Middle school certificate with farming as their main occupation. Farmers in the area have been in business for an average of 15 years with the sugar loaf variety as the dominant variety in the study area. Also, the average age of the pineapple processors was 38 years with an average experience of 9.3 years. The results further revealed that all the processors in the study area were females and have also attained primary education. The processors were found processing the sugar loaf variety with their own funds. The results further found that pineapple marketing business is dominated by women who have acquired JHS/Middle school certificate with an average age of 40 years. The study also

revealed that pineapple production and processing were profitable whereas marketing of the fruit is not.

More so, empirical study rejected the null hypothesis that there was no significant difference in the profit share of the actors. The study found that revenue, capital and planting materials were the determinants of farmer profit; capital, pineapple fruits and packaging materials were the predictors of the processors' share of profit and transportation, revenue and loading and off-loading cost predicts the profit received by the marketer. Although the study found that pineapple farmers, processors and marketers were technically inefficient, there was a statistically significant difference in the efficiency scores of these actors.

It was further revealed that the farmers are faced with the lack of credit facilities, high cost of inputs, product quality and poor agronomic practices as their major constraint. For the processors, lack of raw materials, poor quality raw materials, high transport cost of raw materials and high cost of raw materials were their major constraints whereas the marketers were faced with fruit perishability, poor pricing of pineapple and unfavourable weather conditions as their main problems. Also, the activities by the pineapple farmers, marketers and processors were highly sustainable and very highly sustainable with mean sustainability scores of .62, .69 (farmers and marketers) and.82 (processors) respectively.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIOS

The purpose of the study was to analyse the value added activities along the pineapple value chain in selected districts in the Central Region. This chapter contains the summary of the study, conclusions and recommendations.

## Summary

The study identified that the challenges in the agricultural sector could be reversed, if farmers and entrepreneurs are provided with the incentives necessary to increase productivity and add-value to their commodities to increase their income. They can also gain better access to input and output markets through the development of appropriate linkage with the private sector service providers. In the quest to do this, the value chain concept by Porter was employed. The study answered four research questions on the profitability of the major value added activities along the pineapple value chain in the Central Region, the efficiency (technical and scale) of the major actors along the pineapple value chain in the study area, the constraints of the activities of the major actors along the pineapple value chain in the study area and the sustainability of the major activities along the pineapple value chain in the study area.

The study also sought to test two main hypotheses on the difference in the share of profit among the major actors along the pineapple value chain and the difference in the efficiencies of the major actors along the pineapple value chain.

The study employed the descriptive cross-sectional survey design. The target population was all pineapple farmers, processors and marketers in the selected districts in Central Region.

The sample size for the study was 320 pineapple farmers, 66 processors and 169 marketers. The researcher also made a provision of 10% of each of the samples selected to take care of non-response and other errors that might have occurred during data collection. The data collected was analysed using the SPSS software version 25. The results from the data collected were presented with the aid of tables.

The profitability of the actors along the pineapple value chain was determined by employing the gross margin analysis and the profit function. The profit function helped to determine what causes an actors activity to be profitable or not to be profitable. The Kruskal Wallis Test for K-independent samples was employed to determine whether there exists any difference in the profit share of the major actors along the pineapple value chain. In the same way, the Kruskal Wallis Test was used to compare the differences in the efficiencies of the actors (farmers, processors and marketers)

In analysing objective two, the study employed the Data Envelope Analysis (DEA) technique to determine the efficiency (technical and Scale) of the major actors along the pineapple value chain in the Central Region. To determine the production and marketing constraints of the major actors along the pineapple value chain in the study area, the Kendall's coefficient of concordance was used to rank the constraints. Further, the sustainability of the activities along the pineapple value chain in the Central Region was determined using the Sustainability index model.

## Conclusions

Based on the findings of the study, it is concluded that that pineapple farming and processing business in the central region of Ghana is profitable with average profit of GHs 15,631 and GHs 15,681.3 respectively. Pineapple marketing business is not profitable especially the marketing of the fresh fruits. The revelation in the study was not surprising because the study found fruit perishability, poor pricing of pineapple and unfavourable weather conditions as the major constraints facing the pineapple marketers. The study further rejected the null hypothesis that there is no statistically significant difference in the profit share of the major actors along the pineapple value chain.

Results from the profit function estimation revealed that farm revenue, capital inputs and cost of planting materials (suckers) influence the profit of the farmer; the profit of the processors was also found to be influenced by capital, cost of pineapple fruits (raw materials) and cost of packaging. Finally, the study found that capital, cost of pineapple fruits (raw materials) and cost packaging influence the marketer profit.

Further, the study concluded that pineapple farmers, processors and marketers were technically efficient with mean efficiency scores of .51, .45 and .13 respectively. The mean pure efficiency was .64, .73 and .39 for pineapple farmers, processors and marketers respectively. It was also concluded that the actors (farmers, processors and marketers) who were inefficient could increase their scale efficiency by 23%, 40% and 68% respectively. Also, the null hypothesis that there was no significant difference in the efficiency scores of the actors was rejected and concluded that the efficiency scores of the actors differ significantly from one another.

The study concluded that lack of credit facilities (3.64), high cost of inputs (4.59), product quality (5.80) and poor agronomic practices (5.80) were the major constraints facing the pineapple farmer. The study also concluded that the major constraints facing pineapple processors were lack of raw materials (4.06), poor quality raw materials (4.67), high transport cost of raw materials (5.10) and high cost of raw materials (5.42). Finally, it was concluded that pineapple marketers in the study area were confronted with fruit perishability (3.87), poor pricing of pineapple (3.97) and unfavourable weather conditions (4.24) as their major constraints.

From the sustainability index scores computed for the actors the study concluded that, the activities by the pineapple farmers, marketers and processors were highly sustainable and very highly sustainable with mean sustainability scores of .62, .69 (farmers and marketers) and.82 (processors) respectively.

**Recommendations**

Based on the findings and conclusions of this study, the following recommendations are made:

1. From the empirical research, some actors were found to have the least return on investment; in order to help boost their profit margins, government should develop a sensitisation program that will provide the actors with knowledge on how to cut spending.
   - For each actor to increase their profit margin along the value chain of pineapple, they should have a well-organised cooperative body that will constantly inform them of their product's market value.
   - The cooperative body should be liaising with the District MOFA Office collecting information on pineapple market pricing.

2. Although there are variations between the actors in mean technical and scale efficiency, by adopting the best practices of technically effective ones in the study area, the technically inefficient actors could enhance their technical efficiency. Similarly, by operating in the optimum size, the scale inefficient actors could enhance their productivity and profits.
3. Within the nation, non-governmental organisations and other partner agencies can promote the central region's pineapple industry in various ways to assist decrease the country's poverty. For example, they could work with financial institutions to assist farmers by providing these farmers with credit facilities that will enhance their productivity, profitability, and sustainability.
4. The Government and MoFA should encourage the activities by the actors whose activities were highly sustainable and very highly sustainable to either maintain or improve on their sustainability levels.

**Suggestions for Further Research**

Through analysis of the data and research conducted in this study, the following implications for future research have been suggested.

1. A longer period of research could produce different results since this was just a cross-sectional survey.
2. Also, this study concentrated only on the pineapple value chain, further research can look beyond the pineapple value chain by considering other non-traditional crops in order to establish a more reliable results.

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## APPENDICES

### Appendix A

### INTERVIEW SCHEDULE FOR PINEAPPLE FARMERS

### INTRODUCTION AND CONSENT

This questionnaire seeks to conduct an **ECONOMIC ANALYSIS OF THE MAJOR VALUE ADDED ACTIVITES ALONG THE PINEAPPLE VALUE CHAIN IN SELECTED DISTRICTS IN THE CENTRAL REGION OF GHANA**. I would be very much appreciative of your participation in this survey. I would like to ask you some questions related to the pineapple production which will take you about 15 minutes to complete. Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. However, I hope that you will participate in this study since your views are important.

May I start asking you the survey questions? 1. Yes [ ] 2. No [ ]

***District*** .....

***Community***.....

***Date of interview*** .....

***Name of Respondent***.....

**Section A: Socio-Economic Characteristics of Respondents**

1. Age (as at last birthday) ..... years
2. Sex 1. Male [ ] 2. Female [ ]
3. Marital status 1. Single [ ] 2. Married [ ] 3. Divorced [ ] 4. Widowed [ ]
4. Have you had any form of formal education? 1. Yes [ ] 2. No [ ]

5. If yes, what is your highest level of education? 1. Primary [ ] 2. JHS/Middle School [ ] 3. SHS/Technical or Vocational [ ] 4. Tertiary [ ]
6. Do you have an occupation other than farming? 1. I don't have any [ ] 2. Civil Servant [ ] 3. Private [ ] 4. Other (Specify) .....
7. Number of years in farming .....(Number)
8. What is the size of your household?.....(Number)
9. Indicate the total land used for farming?..... (Acres)
10. What is the total land allocated to pineapple production?..... (Acres)
11. How many pineapple farms do you have?.....(Number)
12. What are the locations of the farms?
    i. .....
    ii. .....
    iii. .....
    iv. .....
13. What is your title to the land you are producing your pineapple on? **(choose all that apply)** 1. Own land [ ] 2. Family land [ ] 3. Rented land [ ] 4. Shared cropping [ ] 5. Other (Please Specify) .....
14. What variety of pineapple do you produce? **(choose all that apply)** 1. Sugar loaf [ ] 2. Smooth cayenne [ ] 3. MD2 [ ] 4. Other (Please Specify) .....
15. What is your source of finance? **(choose all that apply)** 1. Self-financing [ ] 2. Family/friends [ ] 3. Bank loan [ ] 4.

Farmer group/co-operatives [ ] 5. NGOs [ ] 6. Other (Please Specify)

.....

16. Do you have access to extension services? 1. Yes [ ] 2. No [ ]

17. If yes, what service and source?

| **Extension services** | | **Source of extension services** | |
|---|---|---|---|
| Pricing | | Radio | |
| Agronomic practices | | Government extension officers | |
| Post-harvest handling | | NGOs | |
| Output Marketing | | Television | |
| Formation of cooperative | | Fellow producer | |
| Input acquisition | | Seed companies | |
| Other (Specify) ..... | | Other (Specify) ..... | |

**Section B: Marketing channels of pineapple**

18. In what form do you sell pineapple? 1. Fresh form [ ] 2. Juice form [ ]

3. Dried form [ ] 4. Other (specify).....

19. To whom do you sell your pineapple? 1. Retailers [ ] 2. Consumers [ ]

3. Exporters [ ] 4. Hotels [ ] 5. Restaurants [ ] 6. Other

(specify).....

20. Where do you sell your pineapple? 1. Road side [ ] 2. Village market

[ ] 3. Town market [ ] 4. Other (specify).....

**Section C: Cost of Production, Output and Sales last years**

21. Fixed inputs used for the production activity

| **Fixed inputs** | **Quantity** | **Unit cost (GHs)** | **Total cost (GHs)** |
|---|---|---|---|
| Land | | | |
| Shared cropping | | | |
| Tractor | | | |
| Cutlasses | | | |
| Knapsack sprayers | | | |
| Mattock | | | |
| Earth chisel/hoe | | | |
| Boots | | | |
| Drums | | | |
| Other (Specify) ..... | | | |

22. Variable inputs used

| **Production activities** | **Quantity per acre** | **Unit cost (GHs)** | **Total cost (GHs)** |
|---|---|---|---|
| Planting materials | | | |
| Labour | | | |
| Urea | | | |
| NPK | | | |
| Sulphate of potash | | | |

| | | | |
|---|---|---|---|
| Magnesium sulphate | | | |
| Fungicide | | | |
| Insecticide | | | |
| Herbicide | | | |
| Forcing<br>(carbide/earthen gas) | | | |
| Other (Please Specify)<br>..... | | | |

23. What is the quantity of pineapple produced?.....(Per Acre)

24. What is the unit selling price of pineapple?.....(GHs)

**Section D: Production and Marketing Constraints in pineapple production**

25. Indicate the extent to which you agree or disagree with the existence of the following constraints of pineapple production?

(Enumerator should note; circle only one answer in each row)

| Constraints | Strongly Agree | Agree | Somewhat agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Lack of credit facilities | 1 | 2 | 3 | 4 | 5 |
| Erratic rainfall pattern | 1 | 2 | 3 | 4 | 5 |
| High cost of input | 1 | 2 | 3 | 4 | 5 |
| Poor agronomic practice | 1 | 2 | 3 | 4 | 5 |
| Pests and diseases | 1 | 2 | 3 | 4 | 5 |
| Lack of access to current market information | 1 | 2 | 3 | 4 | 5 |
| Seasonal price fluctuations | 1 | 2 | 3 | 4 | 5 |
| Low access to improved variety | 1 | 2 | 3 | 4 | 5 |
| Distance to market | 1 | 2 | 3 | 4 | 5 |
| Low access to extension services | 1 | 2 | 3 | 4 | 5 |
| Product quality | 1 | 2 | 3 | 4 | 5 |
| Post-harvest handling | 1 | 2 | 3 | 4 | 5 |
| Customers taste and preferences | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... | 1 | 2 | 3 | 4 | 5 |

## Section E: Sustainable Agricultural Practices by Pineapple Farmers

26. Please indicate which of the following practices you undertake to sustain your farm business.

| **Agriculture Practice** | Yes | No |
|---|---|---|
| Intercropping | | |
| Integrated Pest management | | |
| Soil management | | |
| Use of green manure | | |
| Mechanical weeding | | |
| Reduced rates of herbicides | | |
| Reduced nitrogen fertilizer rates | | |
| Recycling agriculture wastes | | |
| Reduced use of fertilizers | | |
| Use of animal manure | | |
| Conservation tillage | | |
| Product quality | | |
| Child labour | | |
| Safe working conditions | | |
| Accountability | | |
| Land use | | |
| Management and use of Water resources | | |

## Appendix B

## INTERVIEW SCHEDULE FOR PINEAPPLE PROCESSORS

## INTRODUCTION AND CONSENT

This questionnaire seeks to conduct an **ECONOMIC ANALYSIS OF THE MAJOR VALUE ADDED ACTIVITES ALONG THE PINEAPPLE VALUE CHAIN IN SELECTED DISTRICTS IN THE CENTRAL REGION OF GHANA**. I would be very much appreciative of your participation in this survey. I would like to ask you some questions related to the pineapple processing which will take you about 15 minutes to complete. Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. However, I hope that you will participate in this study since your views are important.

May I start asking you the survey questions? 1. Yes [ ] 2. No [ ]

***District*** .....

***Community***.....

***Date of interview*** .....

***Name of Respondent***.....

**Section A: Socio-Economic Characteristics**

1. Age (in completed years) ..... (years)
2. Sex 1. Male [ ] 2. Female [ ]
3. Marital status 1. Single [ ] 2. Married [ ] 3. Divorced [ ] 4. Widowed [ ]
4. Have you had any form of formal education? 1. Yes [ ] 2. No [ ]

5. If yes, what is your highest level of education? 1. Primary [ ] 2. JHS/Middle School [ ] 3. SHS/Technical or Vocational [ ] 4. Tertiary

6. What variety of pineapple do you process? **(choose all that apply)** 1. Sugar loaf [ ] 2. Smooth cayenne [ ] 3. MD2 [ ] 4. Other (Please Specify) .....

7. What is your source of finance? **(choose all that apply)** 1. Self-financing [ ] 2. Family/friends [ ] 3. Bank [ ] 4. Group/co-operatives [ ] 5. NGOs [ ] 6. Other (Please Specify) .....

8. How long have you being into the pineapple processing business?..... (years)

9. Is the business for you? 1. Yes [ ] 2. No [ ]

10. If no, which position do you have in the business? 1. Manager [ ] 2. Secretary [ ] 3. Accountant [ ] 4. Support staff [ ] 5. Other (Specify).....

11. What type of products do you produce? 1. Sliced pineapple fruit [ ] 2. Pineapple juice [ ] 3. Dried pineapple [ ] 4. Pineapple jam [ ] 5. Other (Specify).....

12. How many workers do you have so far? .....

13. Where do you get the raw materials from? 1. From the pineapple producers located around [ ] 2. From other Districts in this region [ ] 3. From other regions [ ] 4. Other (Specify).....

14. How long does it take for the raw material to reach you from the field? 1. I hour [ ] 2. 2 hours [ ] 3. 3 hours [ ] 4. 4 hours [ ] 5. 5 hours [ ] 6.

6 hours [ ] 7. 7 hours [ ] 8. 1 day [ ] 9. Other (Specify).....

15. Do you do sorting of the raw material before processing? 1. Yes [ ] 2. No [ ]

16. If yes, how do you sort it? 1. Select the enough ripe one for processing [ ] 2. Select big one for processing [ ] 3. Only reject damaged one [ ] 4. Any other characteristic used to sort before processing (Specify).....

**Section B: Cost of Production, Output and Sales last years**

17. Fixed inputs used for the processing of pineapple

| **Fixed inputs** | **Quantity** | **Unit cost (GHs)** |
|---|---|---|
| Knife | | |
| Storage container | | |
| Refrigerator/freezer | | |
| Other (Specify) ..... | | |
| Other (Specify) ..... | | |

18. Variable inputs used

| **Production activities** | **Quantity** | **Unit cost (GHs)** |
|---|---|---|
| Labour | | |
| Pineapple fruit | | |
| Other fruits | | |
| Packaging materials | | |
| Other (Specify) ..... | | |

19. What is the quantity of pineapple processed in a day?.....

20. How much do you sell a processed pineapple fruit (Whole)?.....(GHs)

## Section C: Production and Marketing Constraints to Pineapple Processing

21. Indicate the extent to which you agree or disagree with the existence of the following constraints of pineapple processing?

(Enumerator should note; circle only one answer in each row)

| Constraints | Strongly Agree | Agree | Somewhat agree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Lack of raw material | 1 | 2 | 3 | 4 | 5 |
| Poor quality raw material | 1 | 2 | 3 | 4 | 5 |
| High cost of raw material | 1 | 2 | 3 | 4 | 5 |
| High transport cost of raw material | 1 | 2 | 3 | 4 | 5 |
| Limited access to information on export market requirements | 1 | 2 | 3 | 4 | 5 |
| Limited knowledge on how to process quality products | 1 | 2 | 3 | 4 | 5 |
| Lack of proper packaging material | 1 | 2 | 3 | 4 | 5 |
| Inadequate transport infrastructure | 1 | 2 | 3 | 4 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| Lack of access to current market information | 1 | 2 | 3 | 4 | 5 |
| Lack of funds to acquire modern equipment | 1 | 2 | 3 | 4 | 5 |
| Lack of entrepreneurial training | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... | 1 | 2 | 3 | 4 | 5 |

**Section D: Sustainable practices by pineapple processors**

Please indicate which of the following practices you consider in other to ensure sustainability of your pineapple processing business.

| Sustainable Practice | Yes | No |
|---|---|---|
| Conservation of natural resources | | |
| Conservation of energy | | |
| Reduced pollution | | |
| Reduced harmful emissions | | |
| Use of recycled materials | | |
| Planning and management of land resources | | |
| Environmental protection | | |
| Avoidance of labour discrimination | | |
| Accountability | | |
| Social development | | |
| Product quality | | |
| Economic development | | |
| Child labour | | |
| Management of Hazardous, solid and Radioactive wastes | | |
| Management and use of Water resources | | |

## Appendix C

## INTERVIEW SCHEDULE FOR PINEAPPLE MARKETERS

## INTRODUCTION AND CONSENT

This questionnaire seeks to conduct an **ECONOMIC ANALYSIS OF THE MAJOR VALUE ADDED ACTIVITES ALONG THE PINEAPPLE VALUE CHAIN IN SELECTED DISTRICTS IN THE CENTRAL REGION OF GHANA**. I would be very much appreciative of your participation in this survey. I would like to ask you some questions related to the pineapple marketing which will take you about 15 minutes to complete.

Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. However, I hope that you will participate in this study since your views are important.

May I start asking you the survey questions? 1. Yes [ ] 2. No [ ]

***District*** .....

***Community***.....

***Date of interview*** .....

***Name of Respondent***.....

**Section A: Socio-Economic Characteristics of Respondents**

1. Age (as at last birthday) ..... years
2. Gender 1. Male [ ] 2. Female [ ]
3. Marital status 1. Single [ ] 2. Married [ ] 3. Divorced [ ] 4. Widowed [ ]
4. Have you had any form of formal education? 1. Yes [ ] 2. No [ ]
5. If yes, what is your highest level of education? 1. Primary [ ] 2. JHS/Middle School [ ] 3. SHS/Technical or Vocational [ ] 4. Tertiary

6. Number of years in selling pineapple .....(Number)

7. What is the size of your household?.....(Number)

8. What variety of pineapple do you sell? **(choose all that apply)** 1. Sugar loaf [ ] 2. Smooth cayenne [ ] 3. MD2 [ ] 4. Other (Please Specify) .....

9. What is your source of finance? **(choose all that apply)** 1. Self-financing [ ] 2. Borrow from family/friends [ ] 3. Borrow from bank [ ] 4. Borrow from farmer group/co-operatives [ ] 5. NGOs [ ] 6. Other (Please Specify) .....

10. What is your source of pineapple? 1. Own production [ ] 2. Producers [ ] 3. Other (Please Specify) .....

**Section B: Marketing channels of pineapple**

11. In what form do you sell pineapple? 1. Fresh form [ ] 2. Juice form [ ] 3. Dried form [ ] 4. Other (specify).....

12. To whom do you sell your pineapple? 1. Retailers [ ] 2. Consumers [ ] 3. Exporters [ ] 4. Hotels [ ] 5. Restaurants [ ] 6. Other (specify).....

13. Where do you sell your pineapple? 1. Road side [ ] 2. Village market [ ] 3. Town market [ ] 4. Other (specify).....

14. What volume of pineapple do you sell per day?.....

**Section C: Marketing Margins**

15. What are your units of sale? 1. Pieces [ ] 2. Kg [ ] 3. Heap [ ] 4. Other (Specify).....

16. How do you grade your pineapple for sale? 1. Size [ ] 2. Varieties [ ] 3. Quality [ ] 4. Other (specify).....

17. At what price do you sell your pineapple?

| Units of sale | GHs |
|---|---|
| Pieces/whole fruit | |
| Kg | |
| Heap | |
| Others (Specify) ..... | |

18. When selling pineapple, what kind of transport do you use? 1. Head [ ] 2. Bicycle [ ] 3. Car [ ] 4. Truck [ ] 5. Other (Specify).....

19. What is the cost of transporting pineapple to the market(s)?..... (GHs)

20. What other marketing costs do you incur?

| **Type of marketing cost** | **Cost per kg/pieces/heap/truck** |
|---|---|
| Loading | |
| Off-loading | |
| Sorting | |
| Packaging material | |
| Tax/market dues | |
| Storage cost | |
| Other (Specify) ..... | |

**Section D: Constraints in marketing pineapple**

21. Indicate the extent to which you agree or disagree with the existence of the following constraints with regards to marketing pineapple?

(Enumerator should note; circle only one answer in each row)

| Constraints | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Poor pricing of pineapple | 1 | 2 | 3 | 4 | 5 |
| Poor handling and packaging system | 1 | 2 | 3 | 4 | 5 |
| Market trends | 1 | 2 | 3 | 4 | 5 |
| Unfavourable weather conditions | 1 | 2 | 3 | 4 | 5 |
| Market channels | 1 | 2 | 3 | 4 | 5 |
| Poor storage system | 1 | 2 | 3 | 4 | 5 |
| Fruit perishability | 1 | 2 | 3 | 4 | 5 |
| Product quality | 1 | 2 | 3 | 4 | 5 |
| Consumer taste and preference | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... ... | 1 | 2 | 3 | 4 | 5 |
| Other (Specify) ..... | 1 | 2 | 3 | 4 | 5 |

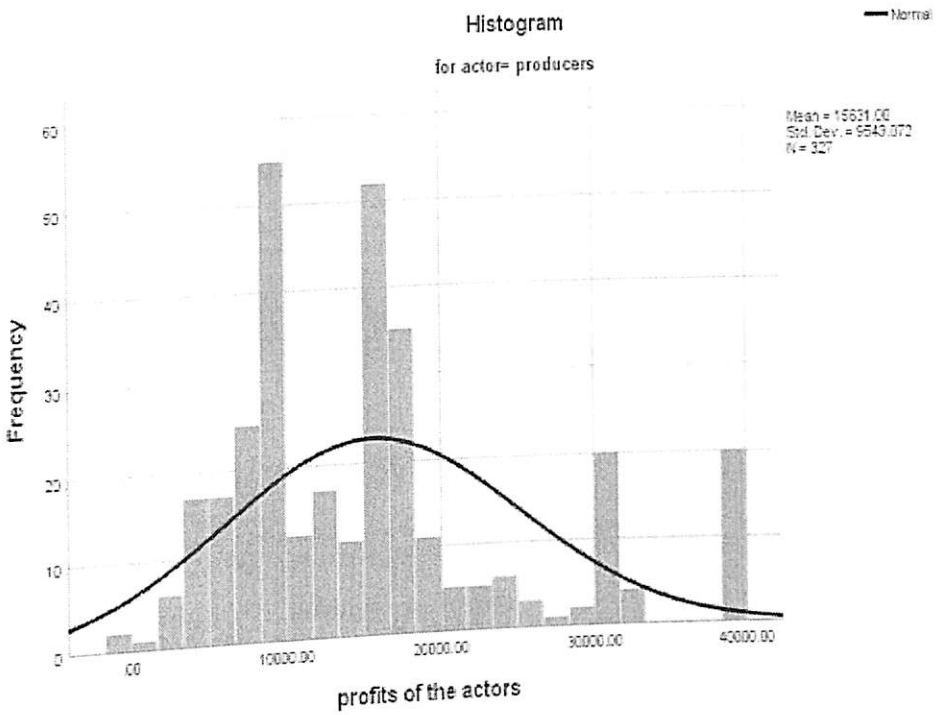
**Section E: Sustainable Marketing Practices**

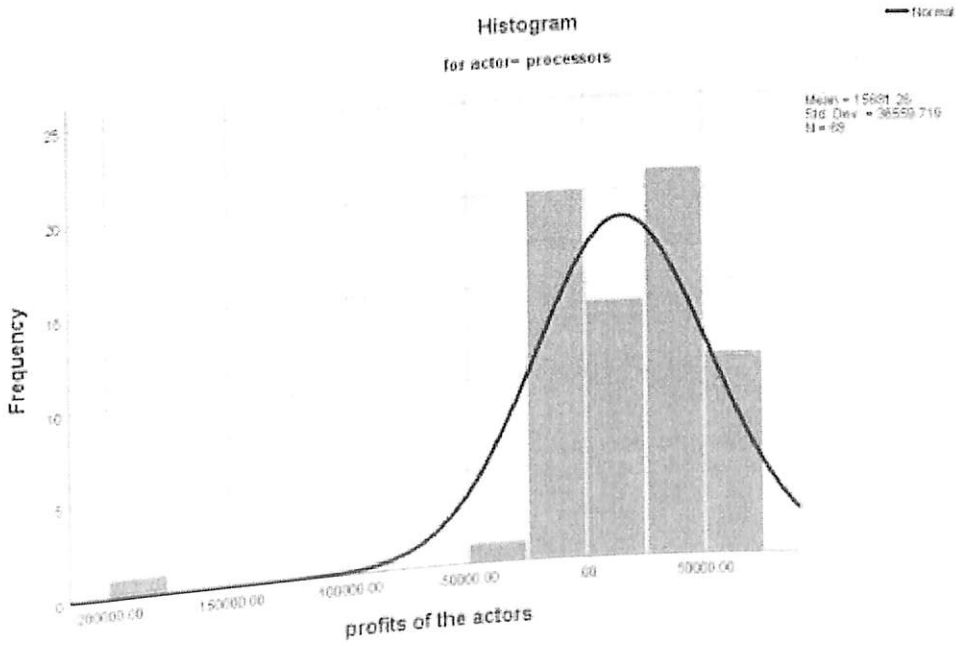
22. Please indicate which of the following practices you consider in other to ensure sustainability of your pineapple marketing business.

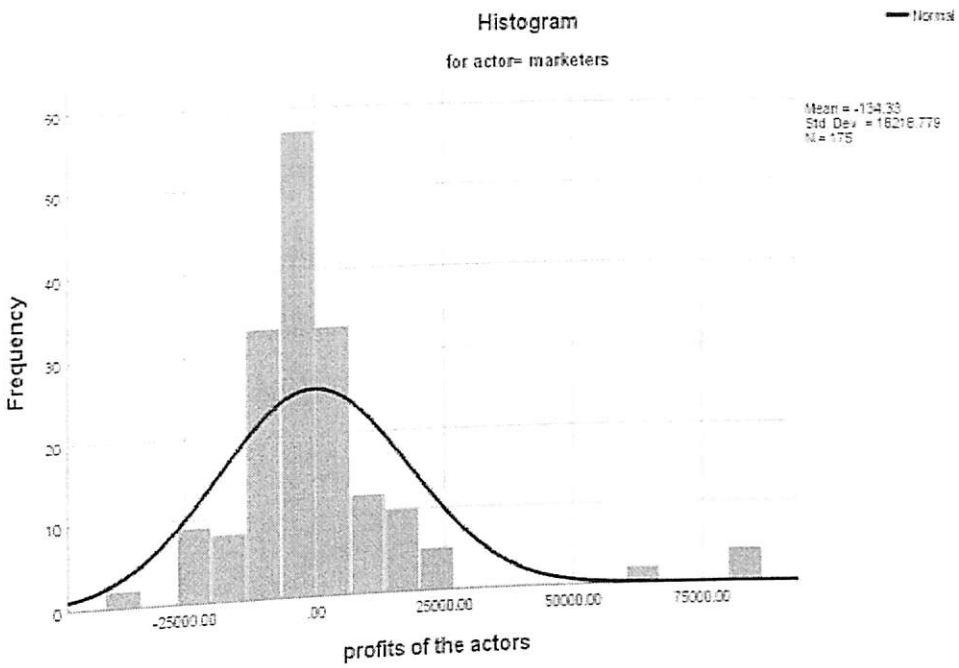
| **Sustainable practices** | **Yes** | **NO** |
|---|---|---|
| Sustainable Promotion Practices | | |
| Avoidance of labour discrimination | | |
| Improved brand reputation | | |
| Efficiency improvement | | |
| Use of Recycled materials | | |
| Sustainable Product Practices | | |
| Good leadership as mouthpiece of members | | |
| Sustainable Price Practices | | |
| Protection of human health | | |
| Sustainable Place Practices | | |
| Child labour | | |
| Contribution of funds to provide social amenities | | |
| Sustainable consumption Practices | | |
| Safe working conditions | | |
| Accountability | | |

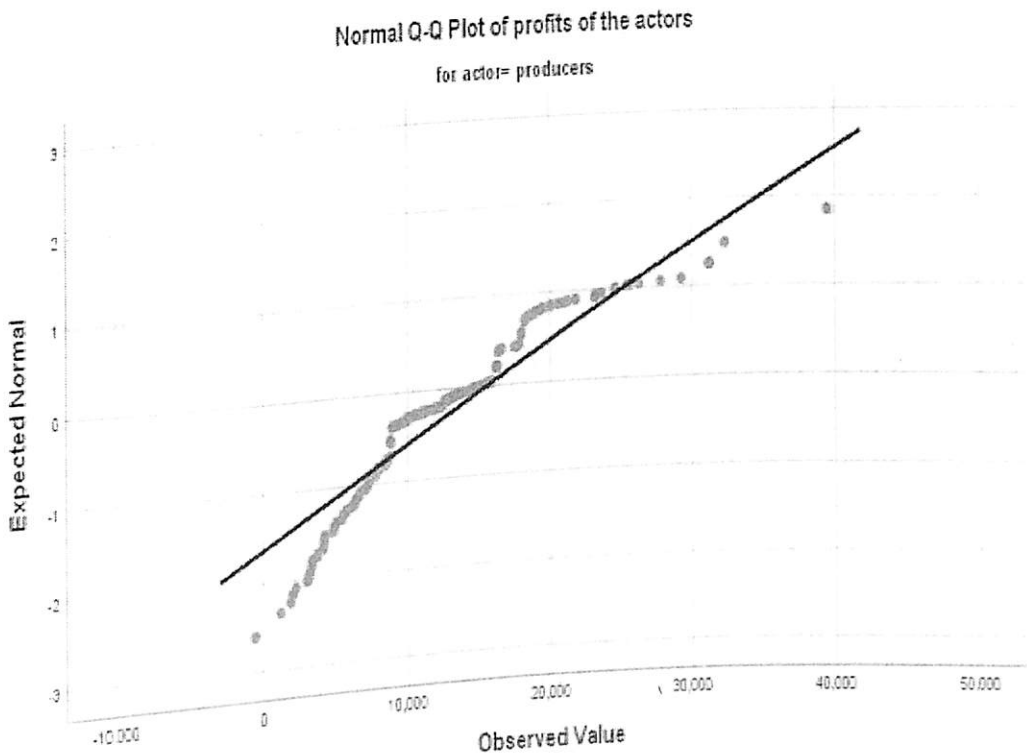
## Appendix D

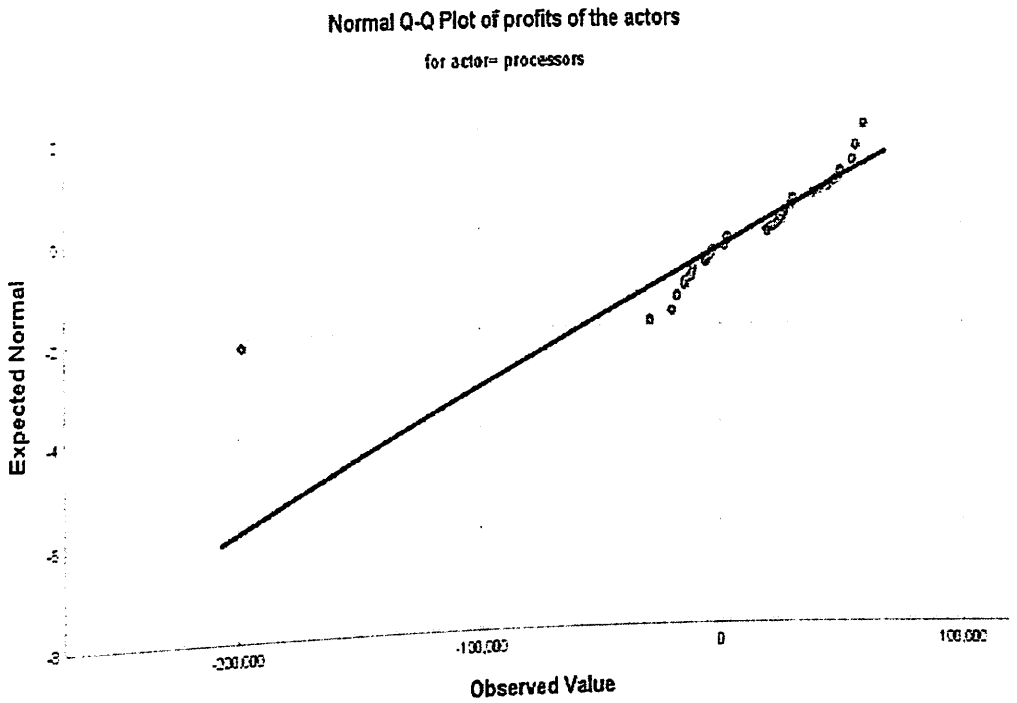
## Normality Test for the profit share of the major actors along the pineapple value chain

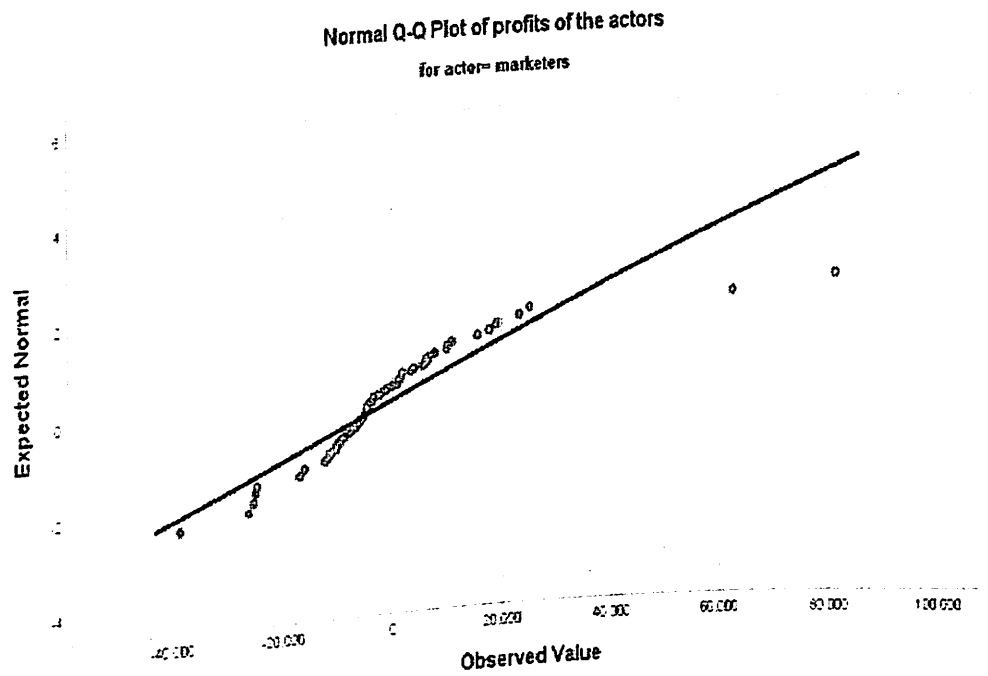



Histogram
for actor= marketers
Normal
Mean = -134.33
Std. Dev. = 16216.779
N = 175
Frequency
profits of the actors
-25000.00
.00
25000.00
50000.00
75000.00


Normal Q-Q Plot of profits of the actors
for actor= producers
Expected Normal
Observed Value
-10,000
0
10,000
20,000
30,000
40,000
50,000


Normal Q-Q Plot of profits of the actors
for actor= processors
Expected Normal
-200,000
-100,000
0
100,000
Observed Value


Normal Q-Q Plot of profits of the actors
for actor= marketers
Expected Normal
-20,000
0
20,000
40,000
60,000
80,000
100,000
Observed Value

## Appendix E

## Sustainability Index Scale for Pineapple farmers

**Classification of Farmers based on the Sustainability Practices in the Farming Business**

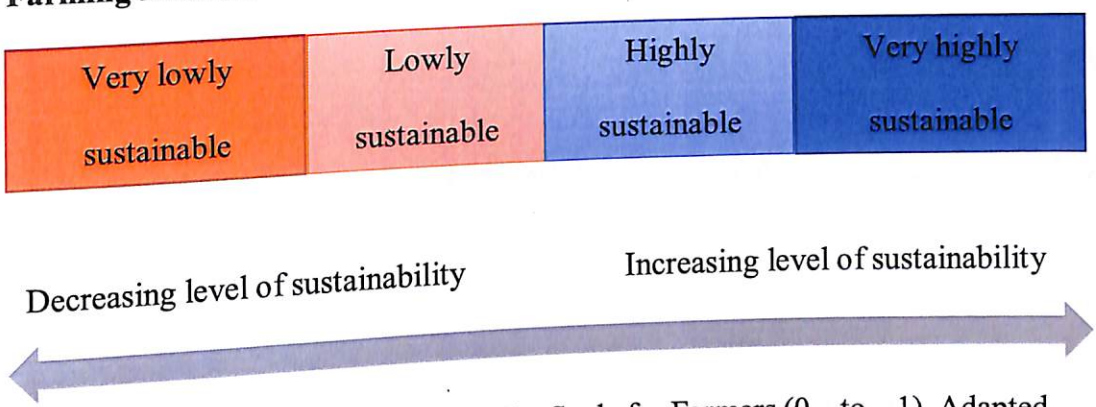



*Figure 4:* Interpretation of Sustainability Scale for Farmers (0 – to – 1). Adapted from Inkoom et al., (2019).

## Appendix F

## Sustainability Index Scale for Pineapple Processors

**Classification of Processors based on the Sustainability Practices in the Pineapple Processing Business**

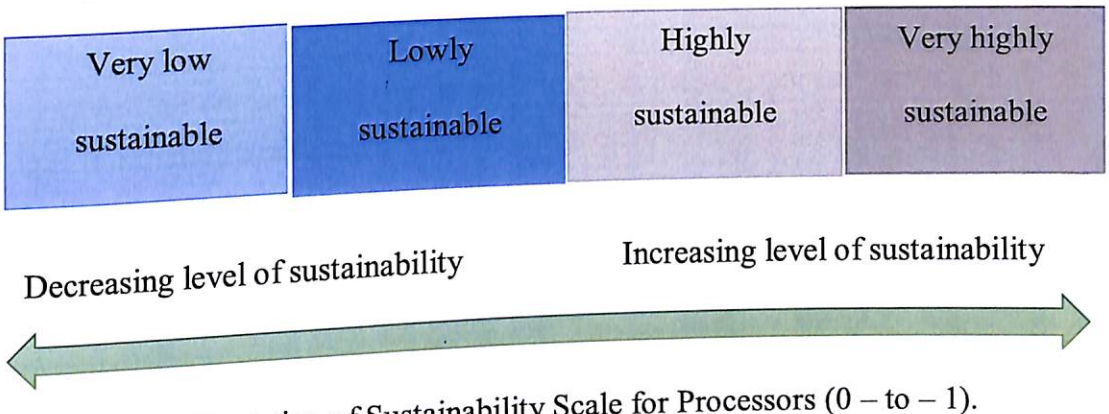



*Figure 5*: Interpretation of Sustainability Scale for Processors (0 – to – 1).

Adapted from Inkoom et al., (2019)

## Appendix G

## Sustainability Index Scale for Pineapple Marketers

**Classification of Marketers based on the Sustainability Practices in the Pineapple Marketing Business**

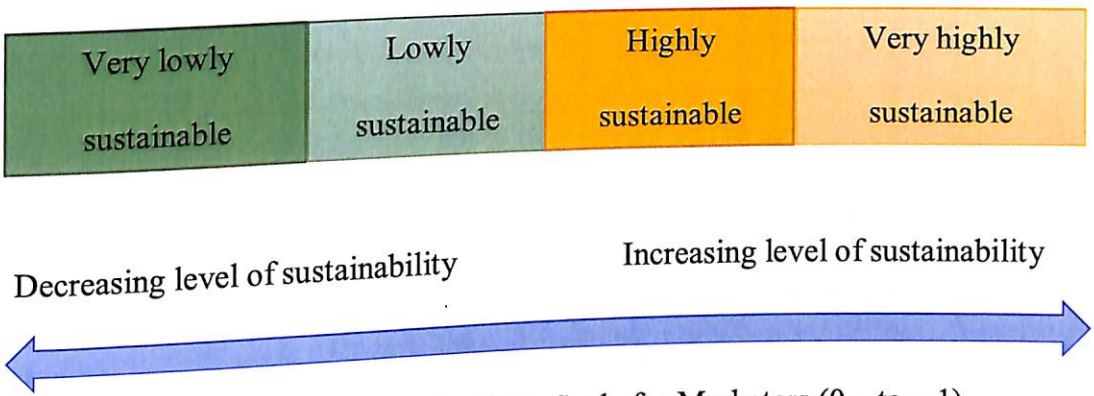



*Figure 6*: Interpretation of Sustainability Scale for Marketers (0 – to – 1).

Adapted from Inkoom et al., (2019)

## Appendix H

## Sample Size Determination Table

*Table for Determining Sample Size of a Known Population*

| N | S | N | S | N | S | N | S | N | S |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 10 | 100 | 80 | 280 | 162 | 800 | 260 | 2800 | 338 |
| 15 | 14 | 110 | 86 | 290 | 165 | 850 | 265 | 3000 | 341 |
| 20 | 19 | 120 | 92 | 300 | 169 | 900 | 269 | 3500 | 346 |
| 25 | 24 | 130 | 97 | 320 | 175 | 950 | 274 | 4000 | 351 |
| 30 | 28 | 140 | 103 | 340 | 181 | 1000 | 279 | 4500 | 354 |
| 35 | 32 | 150 | 108 | 360 | 186 | 1100 | 285 | 5000 | 357 |
| 40 | 36 | 160 | 113 | 380 | 191 | 1200 | 291 | 6000 | 361 |
| 45 | 40 | 170 | 118 | 400 | 196 | 1300 | 297 | 7000 | 364 |
| 50 | 44 | 180 | 123 | 420 | 201 | 1400 | 302 | 8000 | 367 |
| 55 | 48 | 190 | 127 | 440 | 205 | 1500 | 306 | 9000 | 368 |
| 60 | 52 | 200 | 132 | 460 | 210 | 1600 | 310 | 10000 | 370 |
| 65 | 56 | 210 | 136 | 480 | 214 | 1700 | 313 | 15000 | 375 |
| 70 | 59 | 220 | 140 | 500 | 217 | 1800 | 317 | 20000 | 377 |
| 75 | 63 | 230 | 144 | 550 | 226 | 1900 | 320 | 30000 | 379 |
| 80 | 66 | 240 | 148 | 600 | 234 | 2000 | 322 | 40000 | 380 |
| 85 | 70 | 250 | 152 | 650 | 242 | 2200 | 327 | 50000 | 381 |
| 90 | 73 | 260 | 155 | 700 | 248 | 2400 | 331 | 75000 | 382 |
| 95 | 76 | 270 | 159 | 750 | 254 | 2600 | 335 | 1000000 | 384 |

*Note: N = Population Size; S = Sample Size* *Source: Krejcie & Morgan 1970*

*Figure 7:* Sample Size Determination Table by Krechsie & Morgan