COVID-19 AND ITS IMPACT ON THE PROFIT OF MANGO VALUE CHAIN ACTORS IN SOUTHERN GHANA

BY

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ABSTRACT

This study assessed COVID-19 and its impact on the profitability of mango value chain actors in southern Ghana. Specifically, the study sought to analyze the governance structure and linkages that exist in disseminating market information along the mango value chain, examined the determinants of marketing outlets used by the value chain actors (producers, distributors and processors), analysed the impact of COVID-19 pandemic on the profit of value chain actors and also analyzed the various factors constraining the mango value chain in Ghana. Data was collected with a well-structured questionnaire from 240 respondents consisting of 150 farmers, 60 distributors and 30 processors in Greater Accra, Eastern and Volta regions of Ghana. Panel data for 2019 and 2020 production season was obtained from these actors. Social Network Analysis (SNA), multinomial logistic regression, difference in difference and Kendall's Coefficient of Concordance models were used to analyze the various specific objectives whilst using STATA 14 software. Retailers and FBOs were identified to be the most influential and prominent nodes respectively in disseminating market information within the value chain. FBOs were found to be the main bridging nodes in the network. Farm size, FBO membership, quantity produced, reliable customers and gender were found to be the key determinants of mango producers marketing outlet decisions. Ownership of transport, reliable customers, number of buyers and higher price were the key factors influencing the choice of marketing outlet by distributors. Mango processors are heavily influenced by higher prices and gender in choosing their marketing outlet. The outbreak of COVID-19 disease had a negative impact on the profit of mango producers and distributors while processors had positive impact of COVID-19 on their profit. The most pressing constraints confronting the mango producers, distributors and processors include incidence of pests and diseases, post-harvest losses and poor quality of mango fruit respectively. The study concluded that within the value chain retailers and FBOs are the major sources and receivers of market information respectively. Mango producers and distributors experienced a decline in their profit as a result of COVID-19 pandemic while processors profit increased during the COVID-19 pandemic. The study recommends that FBOs and retailers should be central and key stakeholders in policy development for the distribution of market information in the mango sector. Ministry of Food and Agriculture (MoFA) at the district level should encourage mango farmers to increase their farm size and join cooperatives, and distributors should be encouraged to own transport facility to aid in transportation of the fruits to maximize their profits during an exogenous situation like COVID-19 pandemic. MoFA together with Tree Crop Authority should provide mango farmers with the necessary market information and agrochemicals to fight the incidence of pest and diseases like Bacteria Black Spot disease on their farm to produce good quality fruits that are not vulnerable to post-harvest losses.

DEDICATION

This piece of work is dedicated to the Almighty God, my late brother Cephas Kwadwo Ketadzo, Angel Ernest Ketadjo, my mother Comfort Abla Dorglo and loved ones.

DECLARATION

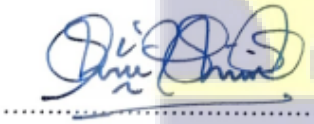
I, **Bright Ketadzo,** the author of this thesis, "**COVID-19 AND ITS IMPACT ON THE PROFIT OF MANGO VALUE CHAIN ACTORS IN SOUTHERN GHANA**" do hereby declare that but for the references which have been duly cited, the work presented in this thesis was done entirely by me. This work has never been presented either in whole or in part for any other degree of this University or elsewhere.

22-11-2022

Bright Ketadzo — Date

(Student)

This thesis has been submitted with our approval as supervisors.



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LIST OF ABBREVIATIONS

ATMA4FS	Agricultural Trade and Market Access for Food Security
EU	European Union
FAGE	Federation of Associations of Ghanaian Exporters
FAO	Food and Agriculture Organization
FBO	Farmer Based Organization
GEPA	Ghana Export Promotion Authority
GDP	Gross Domestic Product
GLOBALGAP	Global Good Agricultural Practices
GVC	Global Value Chain
GHS	Ghana cedis
GSA	Ghana Standard Authority
HACCP	Hazard Analysis and Critical Control Points
MoFA	Ministry of Food and Agriculture
MoTI	Ministry of Trade and Industry
NGOs	Non-Governmental Organization
SNA	Social Network Analysis
TCDA	Tree Crop Development Authority
UNICEF	United Nation Children's Fund
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
WFP	World Food Programme

CHAPTER ONE

INTRODUCTION

1.0 Background

The novel coronavirus disease (COVID-19) began in China and is moving across continents and a total of about 267,038,727 COVID-19 cases have been recorded and out of these cases about 5,282,803 death cases have been reported by 222 countries and territories (Worldometer, 2020b; Schotte *et al.*, 2021). These include cases from both developed and developing countries. Globally, the case count of coronavirus keeps increasing by the day and possess a lot of fear and threat to human life and livelihood. According to the World Food Programme (WFP, 2020), the mortality rate is roughly 3.5 percent, with people over 60 and those with pre-existing health concerns having the highest risk of severe sickness and death.

Apart from being a worldwide health risk, Gupta *et al*. (2020) predicted that the COVID-19 pandemic could pose a significant threat to the global economy, potentially lowering global GDP growth by reducing the percentage score in 2020 (from 2.9 percent to 2.4 percent). After taking counts of the impact the virus has caused in China, Italy, South Korea, France, and other neibouring countries that were early-affected, a lot of these countries have adopted measures to limit the spread of the virus which include: travel restrictions, a ban on public or social gatherings like funerals, weddings, parties, the closure of schools and churches, movie theatres, museums and gyms, and restrictions on opening hours, or closure of restaurants, bars and shops and restrictions on the movement of cargo trucks among others. In most countries, agricultural productivity and distribution may be severely harmed as a result of these steps to contain and treat the COVID-19 outbreak.

The effects vary depending on farming practices or methods, and the extent of exposure in some countries. Because most agricultural activities are seasonal and weather-dependent, a delay in one activity could have an impact on the production process altering yields and as a result, distribution channels or outlets. Containment efforts that restrict mobility and raise corporate costs due to constrained supply chains and market information access and credit limitations have had an impact on economies, resulting in a slowdown in economic growth (Nouh *et al*., 2020; Siche, 2020). These measures are exerting unprecedented recession on agriculture and the world's economy, which is rapidly deteriorating (Mishra & Rampal, 2020). As of June 23rd, 2020, 100 days after the novel virus (SARS COV 2 or COVID-19) was announced, Ghana had 14,568 cases, 10,907 of which had been declared recovered, and 95 of which had been officially certified dead (Amponsah *et al*., 2021; Sarpong & Obeng, 2021).

So far, the disease pandemic has wreaked havoc on the economy and hampered value chain prospects, with several countries still struggling to recover. It can be observed that the outbreak takes a direct toll on the health and movement of value chain actors from input suppliers (farmers) and the final consumers. With producers (farmers) not exempted, one can say that the disease does not only impede the ability of the farmer to produce for others but also undermines their food security and livelihood. Since agriculture, for that matter fruits and vegetable production, processing and distribution is a labour-intensive venture which relies extensively on temporary or seasonal labourers or workers, a lack or a delay of supply of farm produce and its added value produce affects activities and actors along the value chain who depend on this fresh produce or added value product from rural or remote areas to urban centres. During the lockdown, the closure of restaurants, 'chop-bars,' and roadside vendors, for example, disrupted market outlets for farmers, resulting in a drop in income. Farmers' access to input and output markets and accessibility of

market information were limited due to transportation disruptions and lockdown measures (Gray, 2020; WFP, 2020).

Mango (*Mangifera indica*) is a vigorous growing tree that is believed to have originated from Malaysia (Iheji, 2016). Mango is considered as one of the healthiest fruits in the world and a major crop in tropical and subtropical countries (Krishnan *et al*., 2009). Mango is a delicate fruit and, therefore, sensitive to transport due to its perishability. However, there is extensive market interest in fresh mango locally and internationally in processed mango - pulp or dried form.

Globally, mango is produced in more than 90 countries of which Asia, America, and Africa continent contribute about 77%, 13%, and 9% respectively to the total global production (Evans, 2008; Matheyambath *et al.*, 2016). Mango is noted as one of the few horticultural crops that have a long history of cultivation with an increase in production in more temperate zones using protected cultivars. Matheyambath *et al.* (2016) mentioned three major mango trade centres globally. This includes the Middle East, European market, and American market. Literature indicates that Asia supplies Middles East, Africa supplies European market while Latin America supplies American and European market.

The mango production is a major component of the farming business in the Coastal Savannah, Northern Ashanti, transitional zones of the Ashanti and Ahafo regions, and some parts of the Oti region of Ghana. According to Woldesenbet (2013), mango production served as a major source of income for many households and a major source of livelihood for a large number of middlemen, transporters, and traders. Some varieties of mango cultivated in Ghana are Keitt, Kent, Tommy Atkins, Palmer, Julie, Haden, and Erwin. Ghana has a competitive advantage in the production of fresh mangoes and fruits for export due to its favorable climate for fruit growing and proximity to the European market (Okorley *et al*., 2014; Boateng, 2016).

Mango is mainly made into juices and nectars, as well as canned cheeks, segments, or chunks with syrup added during the canning process. Frozen purées or pulps are used in the making of dairy products (yoghurts, for example), ice cream, and biscuits, and constitute a growing market of chocolate and cereal bars among others. The mango industry in Ghana has a complex market structure brought by different actors in the supply chain whose actions affect the farmer's production and marketing decisions. The mango business has contributed greatly to Ghana's economy in terms of employment and foreign cash throughout the years due to its logistical advantage for air and sea shipment (Mensah & Brümmer, 2016). Ghana is one of the few countries in the world with two major mango seasons, allowing for a year-round supply of high-quality fruit to the international mango market (Ganry, 2007).

The gradual growth of agriculture throughout the country has improved job opportunities for individuals through its forward and backward linkages (i.e. supply of fruit to exporters/agro-industries and demand for inputs/services) to other sectors of the economy (Jaeger, 2008). According to Bellù (2013), value chain analysis is the evaluation of a segment of an economic system in which upstream agents in production and distribution processes are connected to downstream partners through technological, economic, geographical, institutional, and social ties. According to Rangegowda *et al*. (2016), value chain analysis is defined as the identification of distinct actors and the precise tasks they undertake in production, assembly, processing, wholesaling, retailing, and consumption. The analysis of the chain helps identify and create opportunities for a technological or functional upgrade of the various actors along the value chain as well as identifying the weaknesses associated with any of the actors along the value chain.

1.1 Problem Statement

Grumiller *et al*. (2018) reported that there has been a recent decline in the pineapple industry which has imperatively caused an increase in the production of mango which is one of the horticultural crops produced in Ghana. As a result of this positive change in mango production, total production increased to about 110,000 tons which contributes about 0.3% to the country's GDP. However, Ghana scuffles to increase export and to produce to feed available processing firms all year round due to a myriad of constraints that limits production, marketing, and development of the mango sector. Even though there has been flagship programmes by the government like *Planting for Food and Jobs (PFJ)* and *Planting for Export and Rural Development (PERD)* the constraints such as post-harvest losses which stand around 30% (Tanye, 2016), lack of functioning pack houses, limited number of GlobalGAP certified producers, pests and diseases remain unresolved.

MoFA (2020) in their Medium-Term Expenditure Framework (MTEF) report for 2020-2023 indicated that there has been significant growth in agriculture as a result of the intensification of agricultural activities over the years especially 2016 and 2017 which yielded an increase in real Gross Domestic Product (GDP) from 2.9% to 6.1% respectively. But GDP recorded in 2018 declined to 4.8%.

The Integrated Tamale Fruit Company, for example, assisted farmers throughout-grower schemes and GLOBALGAP certification to enable them produce and export mangoes from Northern Ghana as part of a government-private sector partnership to develop the fruit sector to meet high export and local demand (Okorley *et al*., 2014). Although mango production and exports have notably increased over the years, the mango sector performance still remained sub-optimal. According to Okorley *et al*. (2014), the mango industry is faced with several challenges such as unstable market price for fresh fruits, incidence of pests and diseases, lack of capital or credit, lack or inadequate

access to market information, and high cost of inputs. For instance, difficulty in accessing and disseminating market information and incidence of pests and diseases among others constrain the production and distribution of fruits in Ghana hence pose a threat to the development of the mango sector. These challenges have been worsened by the outbreak of the COVID-19 disease which imposed a sudden shock on food supply, limited access to market outlets and information, input distribution or supply, production, and marketing hence, the need for market options.

Pan *et al*. (2020) mentioned that the unprecedented measures that were taken during the outbreak of the COVID-19 have hurdled most food supply chains with a reduction in transportation of both raw or processed agricultural products and declined large consumption of perishable foods like fruits (mango) and vegetables as a result of uncertain income. This unprecedented impact of the pandemic on both the demand and supply side of the food chain generally lowers the demand for agricultural products in this COVID-19 era relative to regular seasons. And as a result of these, it is expected that the profit earned in these seasons could be impacted.

On the other hand, Bordi *et al*. (2021) noted that the strict traffic control measures employed in various areas such that products cannot leave the country, raw materials cannot enter in many countries due to the fast-ebbing nature of the COVID-19 virus from region to region and across borders limited access to some marketing outlets, productive resources or inputs and export of agricultural produce. Limited access to some marketing outlets like the export and processing market affected efficient distribution of products like mango fruit from the production points to the market centres. These challenges posed by COVID-19 pandemic affected the profit earned by the mango value chain actors in southern Ghana. Also, Jos (2020) in his policy brief on the *Impact of COVID-19 on Value Chains* pointed out that the first direction of the impact of COVID-19 is on the value chain actors' revenue which is a function of their profit. This impact on their profit

could be attributed to economic slumps resulting from lockdown measures and the shutdown of businesses or factories during the pandemic. Besides, it is expected that mango value chain actors will choose available marketing outlets that maximise their utility amidst the COVID-19 pandemic. Ghana Statistical Service in partnership with World Bank and UNDP reported that the COVID-19 pandemic hindered access to market information for production, processing, and distribution. Also, financial institutions that support firms and businesses have tightened their loan terms hence, making activities and management of these businesses difficult.

According to Badar (2019), the multi-faceted nature of the value chain, not only lowers the value of mangoes to consumers and lowers the income received by value chain actors such as producers and distributors, but also hinders the full potentials of country's industry and socioeconomic growth. Hence this study seeks to address the following; describe the actors and the relationship that exist between them within the governance structure and access to market information, analyze the determinants of market outlet of the value chain actors and the key constraints facing the actors due to the spread of the COVID-19 disease.

1.2 Research Questions

These factors stated above post uncertainties that this research seeks to uncover. The following major research questions may arise:

1. What is the nature of the governance structure and how are stakeholders in the value chain linked in disseminating market information in Southern Ghana?
2. What are the determinants of market outlet decision of the mango value chain actors?
3. How does the outbreak of the COVID-19 pandemic impact the profit of the mango value chain actors?

4. What are the various constraints affecting the mango value chain in Southern Ghana during the COVID-19 pandemic?

1.3 Research Objectives

The main objective of the study is to analyze the COVID-19 and its impact on the profit of mango value chain actors in Southern Ghana. The specific objectives of the study are:

1. Identify and explore the linkages that exist in disseminating market information within the mango value chain in Southern Ghana.
2. Identify and analyze the determinants of mango value chain actors' market outlet choice decisions.
3. Analyze the impact of the outbreak of the COVID-19 pandemic on the profit of mango value chain actors in Southern Ghana.
4. Identify and examine the various constraints facing the mango value chain in Ghana during the COVID-19 pandemic.

1.4 Significance of the Study

By reviewing existing literature on mango production in Ghana, this study provides a holistic picture of existing linkages in disseminating market information in the mango value chain especially in this era of the COVID-19 pandemic.

In addition, the study provides information on the trends in mango production, export, and import and the determinants of market outlet choice decision of value chain actors in southern Ghana. The information provided is expected to help the value chain actors identify the explorable outlets that could maximise their profit or utility.

Furthermore, the study will provide information on the impact of COVID-19 on the profit of value chain actors in the mango sector. The information that will be detailed in this study will enable research and development organizations, traders, producers, policymakers, extension service providers, government and non-governmental organizations, in evaluating their activities and redesigning their modes of operation to navigate through COVID-19-like situations with minimal disruption, and ultimately influence the design and implementation of policies and strategies amidst the crisis.

Finally, the study seeks to highlight the major factors constraining the development of the mango value chain sub-sector and provide recommendations to deal with them. This is envisaged to better improve the production and processing of mango at a larger scale to bring about economic development in Ghana.

1.5 Organisation of Study

This study is grouped into five main chapters. The Chapter one is the preliminary chapter which details the background of the study, the problem statement leading to the research questions, the various objectives of the study, as well as the significance of the study. Chapter two expounds relevant literature on the mango sector in Ghana, trends in production, import and export of mango from Ghana, constraints in the mango sector in Ghana, marketing of mango, value chain and its analysis, value chain upgrade, governance structure, mapping the value chain actors, supply chain concept, COVID-19 and its impact on mango value chain actors, market information access, a brief history on social network analysis, and finally, empirical review. The methodology section of Chapter three outlines the numerous analytical tools and methodologies applied to answer the study's research questions. These include the theoretical and conceptual frameworks, the methods of data collection and analysis and ends with the study area. The results obtained are presented and

discussed in Chapter Four. Finally, Chapter Five concludes with the summary or major findings, conclusion, and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of relevant literature related to this study. It highlights the mango sector in Ghana, the trends in the volume of production, export, and import, constraints facing the mango sector, global value chain, supply chain and value chain concept, marketing channels in Ghana, the impact of COVID-19 on the value chain and finally on empirical results from related studies.

2.1 The Mango Sector in Ghana

The mango sector in Ghana is characterized by input suppliers, producers, distributors, and processors. The activities of these actors in the mango sector have contributed to the development of the sector over the years. Mango production in Ghana comprises smallholders and commercial farmers (Boateng, 2016; Baidoo-Williams, 2015). According to Boateng (2016), about 76% of the total area under mango production is owned by commercial farmers and some farmer-based organizations (FBOs) members while the remaining 24% belongs to individual nucleus farmers. Baidoo-William (2015) mentioned that these 24% mango farmers include out growers who produced for centralized plantations who process and or export their produce.

The mango sector has attracted the interest of farmers and traders for the last seven years due to the rising demand for mango on the international market (Van Melle & Buschmann, 2013). There are three major mango production zones or belts in Ghana: the southern belt around the capital Accra, the Bono and Ahafo belt, and the Northern belt (Zakari, 2012). Fresh mangoes produced in Ghana have varying destinations which primarily include the rural-urban market of Eastern, Greater Accra, Ashanti, Volta, Central region among others mostly characterized by business

activities of wholesalers and retailers as well as export markets for fresh fruit, chiefly to Europe. According to the WACOMP mango cluster diagnostic study report on mango, a large share of about 70% of total production is consumed and given to domestic processing firms. Fruit processing business has expanded into a highly competitive business in Ghana (Van Melle & Buschmann, 2013). According to Abu *et al*. (2020), the Ghanaian mango industry largely produces the Florida varieties (Haden, Kent, Palmer, and Keitt) as compared to other varieties for fresh and processed mangoes which are traded locally and for export (FAGE/USAID/TIPCEE, 2007). The predominant variety produced in the southern belt as found by this study is Keitt. Several other varieties or cultivars are also recognized commercially but are mainly consumed locally.

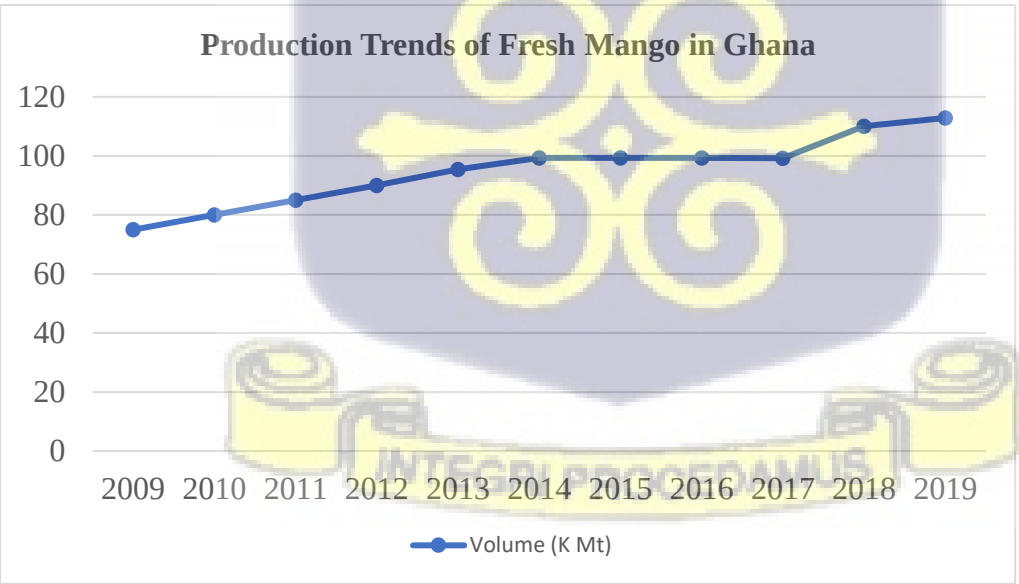
Due to Ghana's climatic condition, the above-listed varieties perform well and this has given the mango farmers to produce in large quantities which are consumed locally and are exported largely by both air and sea freights (Abu *et al*., 2011). This suggests a great potential for farmers who would like to venture into mango production since the mango business seems to be economically viable in Ghana (Boateng, 2016). Abu *et al*. (2020) noted that it will be a great benefit for Ghana to consider using sea freight for mango export and thus profit from cheaper freight rates and the opportunities to move bigger volumes to the international market. Baidoo-William (2015) highlighted that high volume production of mango in high standards to meet growing demand will help Ghana boost its comparative advantage over other countries and thus obtain a real competitive advantage internationally. In Ghana, mango production is made up of lots of small-scale growers who contribute significantly to overall output and export (Baidoo-Williams, 2015, Van Melle & Buschmann, 2013; Boateng, 2016). According to Boateng (2016), membership of FBOs and dispersed individual farmers own about 76 percent of the entire land under cultivation of mango. Pest and disease outbreaks, poor road conditions, post-harvest losses, limited access to credit, low

fruit quality, and land tenure concerns are some of the obstacles the sector continues to face and must overcome to meet both domestic and international demand.

2.2 Trends in Production, Import and Export Value of Mango from Ghana

From *Figure 1*, the volume of production started increasing from 75 thousand metric tonnes to about 99.36 thousand metric tonnes at the end of the 2009 and 2014 production years. This could be linked to an increase in the area of land for mango production over the years. Production kept increasing steadily with a volume of about 99.36 metric tonnes in 2014. Production became a bit stable from 2014 to 2016 and then there was an increase from 99.22 to 112.86 thousand metric tonnes between 2017 to 2019 respectively. An increase in production volume of mango from Ghana gave rise to an increase in export volume from 4760 Mt. to 9405 Mt. from 2016 to 2019 respectively (GEPA, 2020) which are mostly whole fresh or processed of which values generated are represented in F*igure 2*.

Figure 1: Trends in Volume Production of Mango



Source: FAOSTAT, 2020

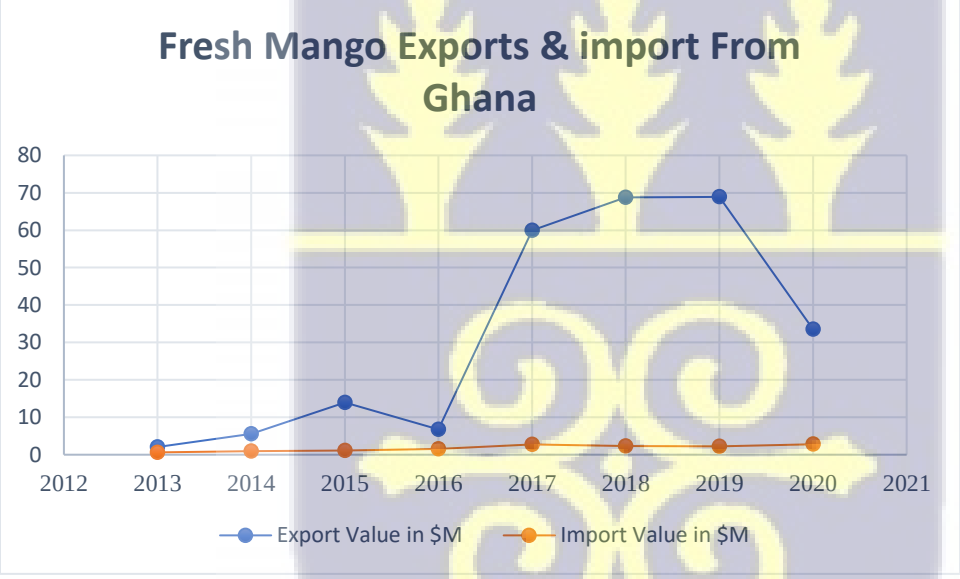
Ghana also deals in processed mango fruits which are in the form of fresh-cut, salads and dried which are exported by processing firms such as Blue Skies, HPW Fresh and Dry, Bomart Company Limited, Prudent Export and Import Company Ltd., Mission Farms Ltd., Volta River Estate Ltd., and Dhillon Farms Ltd among others. According to GEPA (2018) report, major market destinations for Ghana's mango in 2017 include the United Kingdom (US$22.1 million), Switzerland (US$4.6 million), Germany (US$3.45 million), Italy (US$1.8 million), and France (US$1.8 million). The result shown in *Figure 1* reveals that there has been a steady rise in the volume of mangoes exported from Ghana between 2013 to 2015 providing the country with an export value of about US$ 13.93 in 2015. However, the sector saw a decline from 2015 to 2016 with export value dropping from US$ 13.96 to US$ 6.78. This could be attributed to the incidence of pests and diseases especially Bacteria Black Spot (BBS) disease which affected the fruits and eventually reduces the export volume and value (Iddris *et al.*, 2021). Mensah & Brümmer (2016) noted that mango production in Ghana keeps fluctuating thus, restraining the growth of the mango business especially in meeting rapidly increasing export demand.

Meanwhile, most farmers increase their farm size to be able to export their mangoes from Ghana. After slumping in 2016, export volume shot up from 4760 Mt. to 9352 Mt. and generated US$ 59.92 million in 2017. Export volume as shown in *Figure 1* and export value keeps increasing until 2020 when it dropped to US$ 33.52 million. This sudden and sharp recession of export value could be attributed to the shocks implicated by the outbreak of the COVID-19 virus which resulted in the closure of borders by all export destination countries mentioned earlier together with some endogenous factors such as incidence of pests and diseases, unreliable market and post-harvest losses among others. This is summarized by Ragasa *et al.* (2021), who mentioned that the COVID-

19 pandemic has weakened demand, disrupted most supply chains including the mango supply chain, and rendered the commodity (mango) market in a distorted and uncertain state.

Also, *Figure 2* presents the import value of Ghana over the years from 2013 to 2020. The result represents an increase in import value from US$ 0.68 to US$ 2.74 million between 2013 and 2017. However, after 2017 it dropped to US$ 2.27 million in 2019 but finally stood at US$ 2.79 million in 2020. The rise in import value of mango in 2020 could be how the country imports fresh mango and its processed products to supplement what is produced domestically especially during the off-season in a bit of boosting consumers immune system against the COVID-19 virus infection.

Figure 2: Import and Export Value of Mango from Ghana



Source: Tridge (2021)

2.3 Marketing in Ghana

Stern *et al*. (1996) define marketing outlet as a collection of interconnected organizations or an institution that ensures product or service accessibility and availability to consumers. Yadav *et al*. (2013) define a marketing outlet as the path used in moving goods or commodities from the production centres to the consumption centres or points. It serves as the path or medium through

which the product is moved from its producer to the end user or consumer through various auxiliaries such as wholesalers and retailers, who are also known as agents or middlemen. Marketing is primarily concerned with identifying and meeting human and social needs. Gundlach *et al.* (2009), define marketing as a number of activities, structures, and processes for creating, communicating, distributing goods and services that have value for end users, clients, partners, as well as the entire society. Within the marketing outlets, there are intermediaries whose actions and inactions influence the movement of the product. According to Kotler (2005), the channel decision directly influences the marketing decision of the product concerned. Primarily the local market (wholesalers and retailers), processing firms and export serve as the main outlets for mango in Ghana.

2.3.1 Types of Marketing Outlets

Marketing outlets can be grouped into two main types, namely: direct and indirect marketing outlets. Direct marketing outlet occurs when the product or service moves from the producer to the consumer without any intermediary or middlemen involved. It mostly occurs with the sale of services. A marketing outlet is said to be indirect when intermediaries or middlemen are keenly engaged in transferring a product or service to the consumer. This is predominant in the mango sector as compared to direct marketing (Kotler, 2005). The price consumers pay for a product usually increases with an increase in the number of intermediaries in a channel. This is because of the value added to the product by each intermediary.

2.3.2 Mango Marketing Outlets in Ghana

According to Boateng (2016), mango consumption occurs largely in places far from where they are being produced. This implies that the mangoes produced have to be moved from places where they are being produced to the point of consumption. As a result, several middlemen or actors are

involved in transporting mangoes from the initial point of production to the consumption point, hence providing marketing channel(s) of distribution. Mango marketing outlets in Ghana include the export market, local fresh rural and super markets, processing firms, wholesalers, and retailers (Abu *et al*., 2011). These outlets serve as the main absorbers of the produce from the mango farmers. The quantity purchased by these outlets differ. Eghan (2017) categorized the local market into three basic categories, namely the local assembly market, farmgate, highway market, and central market. These outlets together with the export market he reinforced as the major marketing outlets of mango.

Farm-gate: refers to outlets that buy their produce at the farmstead. These outlets buy the farm produce immediately after harvesting usually in larger quantities. Farmers like the farmgate market because it eliminates the cost of transporting their produce to a marketing center (Eghan, 2017).

Local assembly markets: these refer to markets that are organized under huts and sheds and are mostly located within production communities. Aggregators within and near production communities are also included, who travel from one farm to the other and from market to market buying farm produce in smaller volumes, aggregating it, and transferring it to big towns or cities for sale.

Highway markets: this is a fast-growing outlet that sells farm produce mostly fruits and vegetables by the roadside especially highways, usually targeting travelers. The accessibility of this market outlet, as well as the fresh nature of the produce sold, are contributing to its increasing trend. Despite the risk involved in selling by the roadside, many of the people selling in this market regard it as a good market avenue for earning some income to better their livelihood (Eghan, 2017).

Central markets: Generally, these include wholesale markets located in cities or big communities. Produce in large quantities are different farms are transpoted to these markets for sale. These markets serve as the centre for bulk purchases by different buyers.

The processor market: this outlet involves both small-scale and commercial mango processors. This outlet most purchases the mango fruit at the farm gate mostly to avoid post-harvest handling that may affect the quality of the fruit. The mango processors as well as exporters go for fruits with high-grade quality.

The export market: this refers to an outlet outside the country of production. This may include farmers and exporting companies who aggregate the farm produce both from their farm(s) and neighbouring farm and then transport it to a foreign market.

Most of the mango taken to these outlets are unripe (mature green) but physiologically mature. These outlets serve as the middlemen agents through which the mango fruit passes through before getting to the final consumer (Eghan, 2017).

2.3.3 The Roles of a Marketing Outlet Within a Value Chain

A marketing outlet within a value chain performs very vital roles or functions in reaching customers or final consumers with the right product. Thus, the primary objective of a marketing outlet is to provide a connection between production and consumption and to create time, location, and provide utilities that adds to the value of distribution (Usman, 2016). The following are some key functions performed by actors in distribution/marketing outlets.

Actors in the channel or outlet make market information available. The actors gather and distribute market research and intelligent information about actors and forces in the marketing environment which helps in planning and facilitating the exchange of goods and services. Also, they perform

promotion functions by developing and spreading persuasive communications about an offer or product. Again, they perform functions of matching, contact, and negotiation. Matching is concerned with transforming and fitting the product to the consumer's needs. It includes grading, sorting, assembling, and packaging.

2.4 Constraints in the Mango Sector in Ghana

The mango industry in Ghana faces a myriad of challenges in production, marketing and distribution, and processing. Poor market structure, distance from the market, lack of ownership of transport facility, and inadequate market information are some constraining factors reviewed by Makhura *et al*. (2001) as the key constraint facing the marketing of smallholder farmers. Credit bound association with buyers coupled with lack of bargaining power made exploitation of farmers easy especially during a transaction where farmers mostly become price takers. Xaba (2013) stressed that the majority of farmers being smallholders and not having a collective voice made it possible to be exploited and to receive unfair prices for their farm produce. Below are constraints that have been reviewed under sub-heading like production, marketing, and processing.

2.4.1 Production Constraints:

The production of mango requires a group of inputs which includes land, cutlass, fertilizers, irrigation materials, and packaging. Some constraints farmers face includes high input cost, pest and diseases management, lack of irrigation materials among others (Usman, 2016). In light of these constraints, farmers prefer selling out their mangoes in the fresh states as in the case of most other crops produced in Ghana (Okorley *et al*., (2014); Karlan *et al*., 2010). Delay in access to farm inputs such as agrochemicals (fungicides, pesticides among others) and delay in harvesting are some challenges that that affects production such that when there is a little delay in access to

these inputs or its application, it results in poor quality, post-harvest losses and low productivity of the fruit.

2.4.2 Marketing and Distribution Constraints

Poor road conditions that linked production zones, pack houses to the markets, cold chain facilities (available storage, refrigerated trucks), poor fruit quality, post-harvest losses, and freight costs due to low volumes are among the many constraints identified from the literature as factors affecting mango marketing and distribution.

Farmers in Ghana do rarely have access to quality storage facilities on their farms. Due to bulk spoilage and post-harvest losses, many of them are compelled to sell their goods shortly after harvest, regardless of the price offered. This allows for price fluctuations between very low and very high levels, notably during mango's peak and off-peak seasons. Price fluctuations, which are largely beyond farmers' control, make their income unstable and make a major difference in how much a family earns over the year. According to Pardhi *et al*. (2016), the price fluctuation of mango is influenced by the other seasonal fruits in the market. In Pardhi *et al*. (2016) study, about 62 percent of the dependent variable (Mango price) was explained by the selected independent variables (Price of Banana, Sweet Orange, and Apple). This implies that there is a positive effect of other seasonal fruits on the price of mango. This was reflected in the market during the outbreak of the COVID-19 pandemic where there was a demand for almost all seasonal fruits for immune boosting.

Poorly developed transport infrastructure is one of the major constraints that affect the marketing and distribution of mango, especially producers and distributors that send their produce to the market centres. Many of the roads in Ghana from the production zones to market or pack houses are in a deplorable state. Thus, transporting fresh fruits like mango from the farm to the market or

processing firms affect the quality of the mango hence the income earned by the actor (either producer, distributors, and or processors).

2.4.3 Processing Constraints

Mango supply availability and quality, understanding of processors needs by mango suppliers, high cost of raw material, poor road network, cost of imported packaging material, cost of energy supply and consistent delivery, available market intelligence, knowledge of good processing techniques are some of the many challenges facing the mango processing sub-sector.

There are a greater number of mango farmers as compared to processing factories in Ghana. In view of this, the plant capacity in Ghana is insufficient to absorb the bulk or volume of mangoes produced especially during the major season. Also, some of the processing firms cannot store fresh mango fruit to feed their processing machines, especially during mango off-seasons. This forces some of the processing firms to source their fresh mango fruit from neighbouring countries. This increases their cost of production. It is therefore necessary that available firms should organize their supplies and products to be able to absorb fresh mangoes produced domestically in meeting the demand of the processed mango consumers. The quality of transportation of fresh mangoes to processing plants is also hampered by poor road infrastructure in production locations (Gray, 2020).

2.5 The Concept of Value Chain

According to Hailu (2016), an agricultural value chain is a series of actions that includes all enterprises and their activities involved in the distribution of inputs, production, transportation, processing, and supply of the output or products. In the 1980s, Michael Porter coined the phrase "value chain," defining it as "the several operations that were undertaken in particular links in the chain" (Van Melle *et al*., 2008). UNIDO (2009), explains value chain as a “mechanism that allow

producers, processors, buyers, sellers and consumers-separated by time and space-to gradually add value to products and services as they pass from one link in the chain to the next". From the varied definitions, Opoku-Mensah (2020), pinned that the value chain involves a series of activities, a set of actors and participants, a network of working systems and relationships, and an arrangement of linkages aimed at adding value to a product.

Agricultural value chain analysis is a continuous approach that examines whether changes in organizational models, institutional arrangements, and management strategies affect domestic and international commodity demand and supply, as well as technical developments in production and marketing. A value chain is an approach for describing how inputs and services are combined and then used to create, convert, or manufacture a product; how the product is physically transported from the initial producer to the end user; and how value is added along the way as described by Webber & Labaste (2010). A number of actors are involved in the activities required to move a product from conception to final user, ranging from input suppliers through producers and processors to exporters and customers. It is therefore network-oriented and relationship-dependent. Thus, the chains of activities are influenced by four elements which include the end markets, support services, inter-firm relationships, and business-enabling environment. The end markets for the final product give market opportunities and set the criteria for the value chain expansion. Also, the support of financial and nonfinancial institutions enhances the performance of the value chain system (Mataia *et al*., 2020).

The assessment of these chains of operations reveals which sectors are stifling progress – which bottlenecks require immediate attention – and gives a platform for sector-specific action or development (Gor *et al.*, 2012). Also, it helps in policy identification and programming to advance the development and how local businesses can better explore into the global economy. The inter-

connection and coordination among actors ensure the flow of product, knowledge, services, and information (Mataia *et al*., 2020).

The value chain consists of actors who actively participate in the different nodes of the chain and who maintain dynamic relationships. It also involves the enabling environment, including policy-makers, service providers, and civil society, all of which impact the value chain in different ways.

2.5.1 The Global Value Chain

Global Value Chain (GVC) refers to a sequence of processes that goods, commodities, and services go through from the point of conception all through production, marketing, and distribution to the final consumption at geographically distinct locations across the globe (Gereffi & Fernandez-Stark, 2011). Value chains become global when a product moves from one geographic location to another basically across the globe. Most often the GVC is characterised by a long-term relationship that is complex in nature with a high level of inter and intra firm flow of inputs, technology, and credit which is governed by contracts enforced by multinational corporations. These multinational corporations exert control over stringent standards, quality, certifications, prices, and compliance with requirements such as Hazard Analysis and Critical Control Points (HACCP) and ethical sourcing (Opoku-Mensah, 2020). Prices are extremely low domestically for value-added products (Riisgaard *et al*., 2011) however, the Global Value Chain serves as an avenue for smallholder farmers in the agri-food industry to gain access to better prices in international markets thus taking advantage of the potential benefits of high returns relative to the domestic value chain. A better understanding of this enhances productivity, efficiency, and the country's development. One of the key factors that affect mango marketing at the global or international level is standards. Through the help of MoFA and GEPA, most farmers in the mango production areas visited were GLOBALGAP certified. For instance, GEPA documented 120 mango producers or farmers as

members of the Farmer-Based Organisation (FBO) in the Yilo Krobo municipality. Out of these 120 farmers, about 63 farmers are GLOBALGAP certified representing 53% of the FBO members. This suggests that about 53% of the farmers in the Yilo Krobo district who are FBO members produce high-quality fruits which meet international standards and hence could be or are engaged by exporters.

2.5.2 Value Chain Analysis

Value Chain Analysis (VCA) originated from various intellectual streams including Michael Porter's approach to value chains, supply chain management, world-systems theory, and the global commodity chain approach, which was later known as the global value chain approach. Michael Porter's chain was named the French *filiére* (Raikes *et al.*, 2000). The French filiére (chain) approach was used around the 1960s, and this approach concentrates on optimizing the physical flow of products within a particular sector thus, aiming for large-scale value addition and export.

Primarily, this approach was used to analyze French agriculture but was later used in the analysis of agriculture in developing countries, focusing on value addition and improvement of export commodities such as coffee, cocoa, cotton, mango, pineapples among others from the French colonies (Raikes *et al.*, 2000; Lie, 2017). The approach expounds on how the agricultural sector is linked to downstream industries such as trade, processing, and export as well as consumers.

The term "value chain" comes from the work of Porter's (1985) value chain concept that relates basically to a firm-level strategy that focuses on examining the relationships between different actors that perform different activities within an organization. Porter's concept provides an analytical framework that allows firms to identify their competitive advantage source based on cost structure and pricing strategies (Raikes *et al.*, 2000; Lançon *et al.*, 2017). The framework allows businesses to concentrate on the physical transformation of a product, with a focus on input

procurement, product design, marketing and sales, strategic human resource management, and research. Through the successful management of actors and their functions, managers thus enhance the firm's competitive advantage through value addition and positioning in relation to their suppliers, buyers, and competitors (Lie, 2017; Porter, 1985).

Meanwhile, Kaplinsky & Morris (2001) developed VCA which looks at the value chain from the global perspective which many practitioners find useful for its provision of a broader and holistic view. Over the years there has been an increasing gap between the various actors' gains and the relationship that exists between these actors. Thus, Kaplinsky & Morris (2001) developed the VCA approach which provides an understanding of total value gained by a different actor, their activities, and relationship that exist even up to the global economy level (pic actor). And from the global economic level, international relations such as producers, importers, exporters, and retailers providing access to market and suppliers due to knowledge developed are considered in this value chain analysis approach.

According to Biggs (2007), value chain analysis is the process of accounting for and displaying the value which linked the product or service being transformed from its natural material (raw) state to a customer-desired product. It includes market segment analysis, value chain mapping, performance measurement, and benchmarking, all of which enable the identification of performance gaps in a specific value chain. Value chain analysis provides firms with market development in local, regional, and international especially with smaller groups in view which allow for links to be traced. For instance, the activities of smallholder farmers as a target group can be linked to other value chain actors that exist on a local, regional and international level (Herr, 2007; M4P, 2008). Value chain analysis helps analysts and practitioners with a well-structured, yet flexible framework to identify the flow of products and interactions between different actors

in a value chain. Lançon *et al.* (2017) explain that understanding about value chain enables researchers to reflect on the micro and macro levels of production and distribution. From an economic as well as an institutional standpoint, a value chain analysis aids in uncovering the strength, weaknesses, possibilities, and limitations that exist along the value chain.

Also, value chain analysis is a useful tool that helps to identify the efficiency and competitiveness of enterprises and the activities enabling a competitive market environment. It provides practitioners with relevant information related to competitive advantage in terms of cost, value addition, product segment, and upgrading critical success factors for better markets (Luitel, 2017).

Value chain analysis comprises four main components: (i) mapping the value chain, (ii) analyzing the governance structures of the chain, (iii) identification of opportunities for upgrading, and (iv) assessing the distribution of benefits in the value chain.

2.5.3 Approaches to Value Chain Analysis

The Value Chain Approach (VCA) is unique in terms of the scope employed in researching industry and the tangible and non-physical aspects used in developing and executing interventions. Few of other economic development techniques simultaneously highlight all of the characteristics discussed here: a market system perception, a focus on end markets, an acceptance of the importance of value chain governance, awareness of the role of relationships, facilitating changes in firm behaviour, transforming relationships, targeting possibilities, and equipping the private sector. One of several market system methods to development is the value chain approach.

This type of practice has gained popularity among several contributors in a range of circumstances in recent years. While these approaches differ in terms of terminology, frameworks, concepts, and even system definitions, they all agree with the notion that the poor and their economic chances are deeply affected by the dynamic systems in which they operate. Opportunities and outcomes

can be enhanced for the poor by changing how those systems operate. The value chain approach sought to better understand the businesses that operate within an industry, from input suppliers to end-market consumers; the industry's supporting markets that supply technical, business, and financial services; and the industry's operational environment (Kaplinsky & Morris, 2001). Taylor (2005) mentioned some key approaches or areas of focus in assessing the value chain. Some of the significant approaches Taylor (2005) enlisted include, building a clear approach in understanding the VCA, developing supply chain structures and choosing target value stream, developing a roadmap for the structures or facilities within the chain, and identifying and assessing the whole chain issues and opportunities. Primarily, building a clear approach to the value chain requires an understanding of the specific value chain. This necessitates a review of available literature that provides relevant information in understanding the value chain and also highlighting what opportunities and benefits can be derived from along the chain. Understanding a particular value chain helps in identifying the various areas, for instance, the specific marketing outlets to sell farm produce or product to increase utility and improve livelihood. Moreover, one fundamental role of VCA is enhancing the performance of the chain (Taylor, 2005). Having a clearly defined picture of the various structures within the value chain helps in identifying what to variety produce to gain competitive advantage and thus, meet consumer preference. Also, developing supply chain structures along the value chain allows identification of the various actors and structures to give attention to in adding value to the raw material (mango fruit) before it reaches the end-users and selecting the target group that enhances the productivity of the business (eg. The farm business).

In addition, developing a roadmap for the structures or facilities within the chain requires feasibility assessment that allows identification of the facilities available along the chain that can be used in adding value to the mango fruit and drawing a plan on how the products can be moved

to the available facilities for value to be added on before sending to the target market (Hines and Rich, 1997). Taylor (2005) mentioned that assessing the processes that occur at the various facilities helps to identify and quantify the value-added product (eg. mango juice) from the non-added value (fresh mango fruit).

Furthermore, identification and assessment of the issues and opportunities that exist along the whole value chain create an avenue for issues that relate to production (eg. post-harvest handling and losses, mismanagement of pest and diseases) and marketing (eg. poor quality of the fruit and fluctuating prices) to be addressed. Jones & Womack (2002) pointed out that assessment of the chain makes it possible for classification of issues especially for those that relate with physical flow of the product (mango fruit and its processed product) and information flow.

2.5.4 Value-Added Product

Any product that receives additional activities or is integrated with additional products to increase the total value of the product is referred to as a value-added product. Lançon *et al*. (2017) assert that this action boosts the product's economic worth. For example, value addition occurs when a business takes a product that may be regarded homogeneous, with few if any distinctions from that of a rival, and adds a feature or add-on that gives it a higher perceived value. A product's value can be increased or increased by changing its existing location, time, and form features to those that are more popular in the marketplace (Raikes et al. 2000). Value can be added to mango through processing, cold storage, and packaging to give its customers their preferred taste or likes.

2.5.5 Mapping the Value Chain

The *Figure 3* below presents the various actors, linkages, and the role they play in the mango value chain. The mapping involves support institutions such as MoFA, Agricultural extension service providers, development partners and NGOs, financial institutions and local money lenders,

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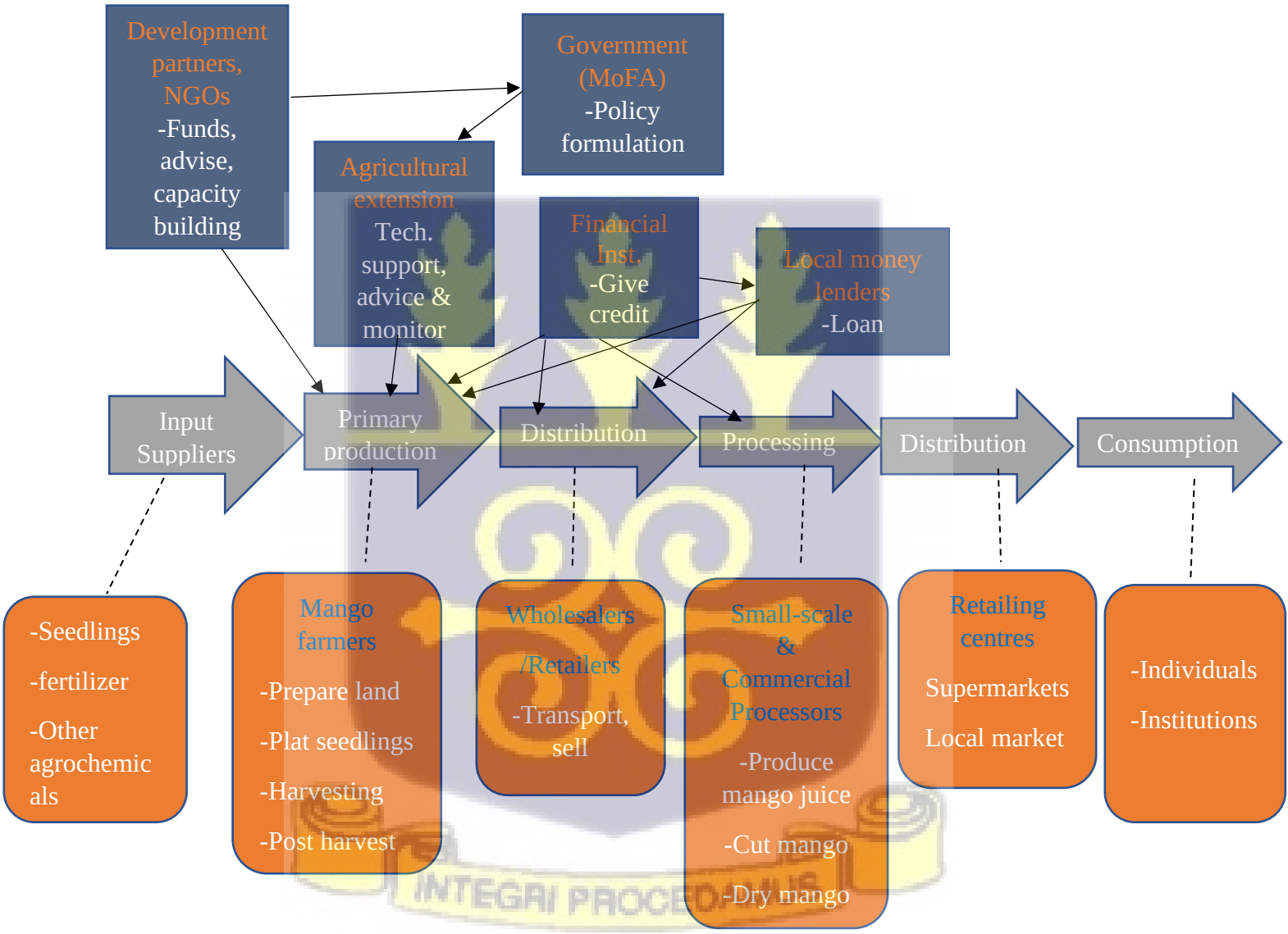
production, marketing and distribution, processor actors, and consumers. The diagram illustrates the direction of their support (⟶), the flow of product or commodity (⇨), and the role they play. From *Figure 3*, it can be observed that the primary point of the value chain starts with the input dealers all through producers, distributors, and processors and ends with the final consumer.

Figure 3: Mango Value Chain Actors, Functions and Existing Linkages



(Source: Adapted from Salifu *et al.*, 2017)

The activities and management of these actors are supported by institutional actors that operate along the value chain in ensuring the efficient and effective operation of the value chain system. For example, input dealers make available inputs such as seedlings, farm tools, crates and boxes, pasteurizers, and processing machines among others that are necessary to the various actors along the chain. The producers acquire the seedlings from the input dealers and then transport them to prepared land.

2.5.6 Value Chain Upgrading

Upgrading is the process of acquiring market-linked technology capabilities that allow businesses to increase their competitiveness and move into higher-value activities (Kaplinsky & Morris, 2000). Upgrading in firms can occur in several forms like process upgrading, functional upgrading, product upgrading, and chain upgrading. Humphrey & Schmitz (2000) and Humphrey & Memedovic (2006) established that upgrading does not isolate the investment in people, their know-how, and processes from improvements in products. Several studies such as Humphrey & Schmitz (2000) and Humphrey (2003) provide an empirical review on the significance of upgrading the agricultural value chain.

According to the literature, process upgrading comprises raising the efficiency of internal processes to the point where they are significantly superior to those of competitors, both within and between individual relationships in the chain. The product upgrading looks at modern products or adding value to old products to be much better than rivals. This entails making some adjustments to design and development procedures both inside individual value connections and in the relationships between them. This enhances the quality of the product than that of rivals. Furthermore, the value created by changing the mix of activities that take place within the firm is

measured by functional upgrading (for example, taking responsibility for outsourcing accounting, logistics, and quality functions). Finally, updating a value chain entail switching to a new one.

2.5.7 Value Chain Governance

The interactions among customers, sellers, service providers, and regulatory organizations which affects the a sequence of activities needed to transport a product or service from the point of production to end users are referred to as value chain governance. Power and the ability to impose influence along the chain are fundamental to governance (Fredrick & Gereffi, 2009). At every point along the chain, certain firms or institutions determine and enforce the parameters which actors must comply with in ensuring efficient delivery of the product. What is to be produced, which includes product design and specifications, how it can be created, which includes manufacturing methods, and finally how much is to be produced and when to produce are the essential elements that inform governance. This refers to the logistics and scheduling of production. Chain governance occurs when some firms operate to meet the standards set by other competing firms in the chain. There are many types of value chain governance;

- *Market*: Market governance involves the making of products from minimal inputs from buyers, simple transactions, and transmission of product information on product specifications (Mugabira, 2017).
- *Modular value chain:* Modular governance is another type that occurs when the nature of products requires firms in a chain to take up complex transactions that are easy to be structured up.
- *Relational governance* is a governance pattern where mutual reliance between firms usually through social, reputations, or family affiliation influences the transfer of information and embedded services between buyers and sellers (Williamson, 1983; Mugabira, 2017).

- *Captive governance* is a chain where small suppliers depend on a few buyers that wield a great deal of power and control. There is a high degree of monitoring and control by the lead firm.
- *Hierarchical governance* refers to a set of lead enterprises that create and manufacture products in-house and are characterized by vertical integration and management oversight. When product specs cannot be sorted, products are complex, or there are no highly skilled vendors, these systems emerge (Mugabira, 2017).

Governance can be exercised in different ways, and different types can be exercised even in the same chain (Humphrey & Schmitz, 2000).

Thus, the study employed the grading (scoring) exercise used by Kaplinsky & Morris (2000) with variables identified from literature which could make an actor exercise "importance" and "influence". The variables of interest include profit, bargaining power, and information concentration. According to Clottey (2014), "importance" is analyzed as an actor's capacity to exercise some level of force and influence within the chain, while "influence" refers to the power that an actor possesses in exerting control and effect on other actors present in the chain. The mean score of all the actors in question such as producers, distributors, and processors were calculated of which each total score amount to 100%. The score reflects the strength of the variable for each actor. This implies that the higher the score (%), the better the level of importance and influence the actor carries within the chain. Hence, the actor with the highest score is considered the dominant actor along the mango value chain.

2.6 Supply Chain Concept

The supply chain is a linked set of activities that deals with the planning, coordination, and management of material parts and finished commodities from suppliers to customers. It is

concerned with two distinct flows of material and information through the organization (Steven, 1986). The scope of the supply chain begins with the source of supply and ends at the point of consumption. “A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, a transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers” (Huang *et al.*, 2002). The supply chain involves decision-making to ensure that customers receive the right product. Decision making regarding the supply chain both individually or collectively must encompass five major areas:

- *Production* -This examines the type of product that the market wants, as well as how much of each product should be produced and when. This task includes developing master production plan that takes in consideration the plant capabilities, quality control, and equipment maintenance (Huang *et al*., 2005).
- *Inventory* - What inventory should be put in stock at each stage in a supply chain to meet future demand? How much raw materials, semifinished items, and finished goods should be kept on hand? This is because inventory's primary function is to act as a buffer against supply chain uncertainty (Huang *et al*., 2005).
- *Location* - The location of facilities for production and inventory storage is crucial in supply chain decision-making. What are the most cost-effective locations for manufacturing and inventory storage? Should current facilities be utilized or should new ones be constructed? Once these judgments are established, the possible channels for product flow are determined, allowing for easy delivery to the final customer.
- *Transportation* - What are the various means to transport goods from one supply chain site to another? Moving inbound supplies from supplier locations to manufacturing facilities, shifting

inventory across different factories and distribution centers, and delivering final products to clients are all part of seamless supply chain activities. When making supply chain decisions, it is preferable to consider the fastest and most dependable mode of transportation for delivering the goods to the final client (Gray, 2020). For example, the use of Airfreight and truck delivery of mangoes are generally fast and reliable but they are expensive. While shipping by water is less expensive, it usually requires longer transit times and more risk. Higher volumes of inventory must be stocked to compensate for the unpredictability (Steven, 1986; Huang *et al*., 2005).

- *Information* - Better coordination and decision-making can be achieved with timely and reliable information. Thus, it is necessary to ask how much data to collect and how much information should be shared? With accurate information, effective decisions can be taken to inform what to produce and the volume to produce, destinations to locate inventory, and how best to deliver the product.

The summation of these decisions describes the proficiencies and elaborates how effective a firms supply chain is and how it can thrive in the market in meeting customers' demands (Hugos, 2018).

2.7 Performance Analysis

2.7.1 Social Network Analysis (SNA) and Market Information Access

Several studies traced back the network analysis to Euler's development of Graph Theory (mathematics) in 1736, of which the antecedents of SNA in particular spread to Comte's notion of ''social physics'' in the early 1800s. Until the early 1930s, there was a divergent perspective of the historical development of SNA between the U.S and the Europeans (Dempwolf & Lyles, 2012).

Borgatti *et al*. (2009) mentioned in their study on network analysis in Social Sciences that in the 1930s, Moreno and his colleague Jennings conducted a study on teenage run-aways from the

Hudson School in upstate New York. In their study, they measured and mapped the various friendship ties between the girls which Moreno called "Sociogram". The study revealed that the friendship ties show the location of the girls and the structure of influence as to whether they ran away, or if so, when. This study together with Sociometry merged the historical development of SNA around the 1930s. Moreover, mapping of actors, relationships, and interactions as networks and the application of graph theory and matrix algebra to visualize and analyze network data and structures increased in the 1940s, 50s, and 60s (Dempwolf & Lyles, 2012; Moreno, 1934). For example, in 1957 Bott's examined the influence of spousal roles among British families using social networks. His finding revealed that forms of network ties that exist among spouses influenced whether they share responsibilities or are still held to a customary division of responsibilities between husband and wife (Bott, 1957). During that time, there was a high surge in the application of SNA techniques to studies by the Sociology community which had advanced the understanding of urbanism and community structure. For instance, Hollingshead (1949), documented the influence of cliques on adolescent behaviour, and Fischer (1948) pinned that urbanization reduces network density in California (Borgatti *et al*. 2008; Dempwolf & Lyles, 2012). By the 1970s, SNA was adopted by a group of researchers from the Sociology society led by Lorraine and White. The group focused on issues related to roles, network position, and structural equivalence which allowed several students to be trained. Many of these students emerged as great scholars whose studies reveal the various functions, benefits, and weaknesses of the SNA technique. A study conducted by Granovetter (1973) on *The Strength Of Weak Ties* provides an understanding of network interactions which has been cited in several studies from different disciplines.

According to Ameru *et al.* (2018) market information process entails gathering agricultural data based on market prices (spot or futures), quantities supplied to the market versus quantities sold, and other market-related data on a wide range of agricultural products. The data comes from a variety of marketing channels as well as a number of trustworthy information sources. After the data has been gathered, it is analyzed and packaged in a user-friendly style before being distributed to farmers, merchants, government officials, and other interested parties through various communication channels. Agricultural marketing information refers to all facts and information related to agricultural activities which are relevant in making marketing decisions and which could invariably influence the marketing operation of an agricultural business.

Marketing information can be categorized as either up-to-date, current information, or information compiled over time (historical information) (Megasa *et al.*, 2014). Svensson & Yanagizawa (2009) narrated that while current information aids farmers with efficient bargaining strength, historical information guides them in planning their production, storage decision, and early harvesting to meet market demands. Access to market information has many benefits for actors along with the value chain system. When value chain actors, for instance, mango processors have access to current market information it will assist them in identifying better-marketing outlets and could influence their participation. Also, market information accessibility helps farmers to schedule the harvest at a more profitable time to be able to maximize utility. FAO (1997) writes that access to market information about prices over a season or more could offer farmers valuable information to diversify into new crops or grow different variety that meets market preference. Access to market information could help reduce the transaction cost of mango value chain actors and also prevents urban consumers from facing alternating gluts and shortages of mango fruit and its related products. Market information accessibility provides transparency which creates awareness to all

parties about prevailing market prices and other market-relevant information (Shepherd, 1997; Magesa *et al.*, 2014). Improvement in the transparency of the marketing system reduces the riskiness associated with participating in some markets. Based on this, market participants decide the particular marketing outlet to participate in to be able to take advantage of expected higher prices. Finally, accessibility of market information keeps value chain actors abreast with the competitive condition and market environment which helps reduce the communication gap between producers, distributors, processors, and their respective consumers (Ferris *et al*., 2008).

2.7.2a Impact Assessment

Beyuo & Anyidoho (2021) compared the differences that exist in the nature and impact of the various methods employed by two NGOs carrying out food security programmes in some areas within the Upper West Region of Ghana. About 250 beneficiaries and 100 non-beneficiaries were engaged for their study of which they employed the difference in difference model to evaluate the impact of participation on food security. The results found by their study reveal that more participation in the food security programme significantly impacts beneficiaries' food security and hence, penned that meaningful participatory approaches are necessary for an intervention to enhance the food security of rural people.

Kibira *et al*. (2015) assessed the economic benefits of adopting an integrated pest management (IPM) package that included male annihilation technique (MAT) and augmentorium application to control mango-infesting fruit flies in Kenya. The impact of mango IPM on the amount of mango rejection, pesticide cost, and net revenue was investigated using the difference-in-difference (DiD) approach. The study highlighted that there was about a 54.5% reduction in the magnitude of mango rejection as a result of participation in the IPM programme by the mango farmers which also reduced the insecticide expenditure by 46.3% per acre. Their study mentioned that these results

increased the net income received by the farmer by 22.4% as compared to non-participants. Kibira *et al*. (2015) added to the literature that application of the fruit fly IPM technology by mango farmers would positively and significantly influence the income generated by the farmers and thus, the intervention should be expanded in mango-growing areas in Kenya.

2.7.2b COVID-19 and its Impact on the Mango Value Chain

The COVID-19 pandemic hit has become a thing that is staying with countries all over the world. The increased infectious nature of it has kept countries and their health workers on their toes as a little negligence could cause huge damage to nationals. The virus' widespread has affected numerous sectors of the Ghanaian economy, including agriculture, services, and industry. Along the agricultural value chain, farmers, retailers, and processors have all suffered losses. Most farmers, retailers, wholesalers, and other actors in the value chain system were affected by social distancing, partial lockdown, and movement restrictions that culminated in the closure of some market centers around the country. Some of the pandemic's effects may not be completely seen right now, but the agriculture sector will be negatively impacted shortly because food security is critical. According to FAO (2020), the outbreak of the COVID-19 pandemic caused a serious economic downturn. The downturns slowed a lot of systems which resulted in job losses and other disruptions such as food and fruit export and importation, sales, and procurement of resourceful inputs for agriculture production, marketing, and trading systems. For instance, there was a shortage of labour to support agricultural production which put the quality of fruits and diets at risk. Due to these shocks, food unavailability, hunger, malnutrition, food insecurity, and insufficient funds were some results of the COVID-19. FAO projected an increment of 14.3 percent or 6.7 million people to suffer undernourishment or acute malnutrition due to the pandemic (FAO, 2020; WFP, 2019).

Field monitoring and interaction with farmers and Agri-SMEs show that if strategic investments and focused support are not made in the agriculture sector, there would be a shortfall in food production, putting the country's food security in jeopardy.

In Ghana, there are lots of smallholder farmers that grow various crops such as fruits, vegetables, etc. that are exported to Europe, China, America, and some other places. COVID-19 made exports come to a halt bringing the volume down as land, sea, and air borders were closed or restricted around the world. “The corona virus has stopped all of our shipments,” Alex Kravecas, owner of MakolaHub Fresh, told freshplaza.com in an interview in 2020. Commodity prices were also sky-rocketed. For instance, the price of maize in December 2020, surged so high that many could not afford while other products and businesses that depended on corn had their prices increased significantly (Kilic & Marin, 2020)

Most mango farmers in Ghana produce to feed both the local markets and the international market. The majority of the mango producers (farmers) move to local markets to sell their produce while some buyers being it wholesalers, retailers, or middlemen move to buy directly from farmers. Market closures and other limitations had a significant impact on these farmers and businesses. COVID-19 had an equal impact on fruit processors, as some were unable to obtain the raw materials required for production, while others couldn't get enough. Fruit prices have risen significantly as a result of the supply shortfall. Also, some processors laid off their workers to cut down their production costs, while some small-scale processors ended up shutting down entirely.

While some lamented on the negative effects of the COVID-19, some dried mango fruit businesses rejoiced as they made significant profits during these times as a result of increased consumption to build the immune system with more essential vitamin A and C. Around 90% of naturally dried

mangoes exported to Europe are taken from Africa. West Africa alone contributes about 60-65% of the supply while South Africa contributes 30% and the rest of the supplying countries, a mere 10-15%. COVID-19 is not expected to have any serious negative impact on the consumption of this dried fruit. On the contrary: during the crisis, many companies in Ghana stockpiled their dried mangoes as dried mangoes are also shelf-stable food. The only factor that prevented a stronger increase in consumption is the increase in retail price. On average, export, wholesale and retail prices are significantly higher compared to those of most other dried fruits on offer.

2.7.3 Multinomial and Logistic Regression

A logistic regression model is an analytical tool that explains the relationship that exists between one dependent variable and one or more independent variables. While the dependent variable is binary, the independent variables can be nominal, ratio-level, interval, or ordinal.

In general, the multinomial and logistic regression models have been used by several analysts and documented. Adu (2018) applied a binary logistic model to reveal the factors affecting rice farmers' choices of marketing outlets. The choice alternatives in her study were direct market outlet (processors) and indirect market outlet (middlemen). Ouko (2016) applied the multinomial logit model to determine how socioeconomic characteristics influence the choice of *Seed Sources of Smallholder Bean Farmers in Bondo Sub-County in Kenya* whereby his choice alternatives were his own saved seed source, neighbouring farmers Local and grains market seed source. Fertő & Szabó (2002) made use of the multinomial logistic model in analysing the various factors determining the selection of supply outlets in the Hungarian fruit and vegetable sector. The various choice alternatives identified in his study were found to wholesalers, marketing cooperative chains, and production lines. Meanwhile, Tadesse (2011) adopted the multiple linear regression as an analytical tool to examine the factors influencing the supply of avocado and mango in Gomma

Woreda, Jimma Zone, Oromia National Regional State in Ethiopia. The choice alternatives identified in his study were wholesalers, retailers, assemblers, and processors. Additionally, Jari & Fraser (2009) employed the multinomial logistic regression model in analysing institutional and technical factors that influence agricultural marketing channel selection amongst the smallholder and emerging farmers in the Kat River Valley in South Africa. In the model, the smallholder farmers were interviewed on their choice of the three possibilities of market participation, viz. formal markets, informal markets, and not participating in markets, which was set as the dependent variable.

2.8 Empirical Review

2.8.1 Value Chain Assessment

Several studies have looked at the value chain in Ghana. Notable among them is value chain analysis studies performed by Salifu *et al*. (2017) who analysed the Groundnut Value Chain in Ghana. In their study, the key actors identified within the groundnut value chain in Ghana were producers, distributors, and processors whose roles and activities are critical in adding value to the groundnut before reaching the final consumer. Their result on cost and returns revealed that for every litre of groundnut oil and kilogramme of a paste produced from groundnut along with the oil and paste chain respectively, most of the benefit goes to the farmer who sells his or her groundnut in the shelled form. And the next actor that derives a greater benefit from the groundnut along the oil and paste chain is the retailer, a sub-actor under distributors. The processors were found to be the least beneficiaries along with the groundnut oil and paste chain. Meanwhile, when a farmer sells groundnut in a shelled form, about 116% of the profit or benefit goes to the groundnut distributors. Further analysis of return on investment per day highlighted distributors as the actors that benefit more along the groundnut value chain. Also, the study of Salifu *et al*. (2017)

looked at power relations that exist between the actors in the groundnut value chain and came out that distributors are the dominant governors along the chain. Among the constraints identified in the study area, high cost of transportation and lack of access to credit facilities were identified in the marketing and processing segment respectively. The study noted a number of opportunities for the groundnut value chain in the study area which includes employment and availability of market and labour.

Moreover, Kleeman (2011) used a value chain approach for an in-depth search on "Organic Pineapple Farming in Ghana - A Good Choice for Smallholders?". Using extensive data from the European market, the study threw light on the feasibility and profitability of organic small-scale production in Ghana. The study reflects the fruit quality problem faced by the smallholder farms relative to large farms that benefit from economies of scale. However, the study points out the export market opportunity available to both organic and conventional farms. Findings from Kleeman (2011) further revealed that organic production is more profitable in Ghana for smallholders compared to conventional production. This is as a result of a fair share of the price premium on the retail level that farmers benefit.

2.8.2 Social Network Analysis (SNA) Approach

Onumah *et al.* (2021) performed a qualitative study using the SNA approach that focused on "Actor roles and linkages in the agricultural innovation system: options for establishing a cocoa innovation platform in Ghana". In their study, quite a number of actors were found to be the core actors, having some linkages (ties) with other actors in the cocoa innovation system. These actors include Cocoa Health and Extension Directorate (CHED), FBOs, CRIG, LBCs, COCOBOD, Solidaridad, and International NGOs. Their several linkages or ties with other actors in the system illustrate the important role they play in the cocoa innovation system. Centrality measures using

the UCINET software in their study revealed that extension actors (CHED) had the highest out-degree score, with FBOs having the highest in-degree score. This means that these extension service providers in the cocoa network are the most influential actors and thus, initiate more interactions than they received from other actors. FBOs having the highest in-degree score suggest that they are the most prominent actor in the cocoa innovation network. This is because most of the interactions are directed to rather than individual farmers.

Moreover, Nyantakyi-Frimpong *et al*. (2019) employed SNA coupled with exponential random graph models (ERGMs) to assess "smallholder farmers' social networks and resource-conserving agriculture in Ghana". The study examined the various types of information network structures that exist within rural cooperatives and the role of these structures in promoting resource-conserving agriculture. In other words, the study sought understanding into whether and how environmental outcomes correlate with microlevel social relations or network structure. The key findings were that farmers who have more biomass accumulation from the adoption of agroforestry practices tend to relay the knowledge acquired to their colleague farmers at the local level. In other words, these farmers that have a large volume of biomass tend to be chief advisers to their peers at the local level demonstrating that farmers at the local level tend to look for peers who have successfully achieved land management goals.

Also, Weyori *et al*. (2017) reviewed a study on "Agricultural innovation systems and farm technology adoption: findings from a study of the Ghanaian plantain sector". The study employed the SNA approach in assessing farm technology adoption in the Ghanaian plantain sector. The study identified some key innovation system actors in the plantain sector notably plantain farmers, CRI, extension agents, NGOs (e.g. World Vision International), input dealers, market women, and processors. These actors were found to be the disseminators of information about plantain

technologies and market information (e.g. prices, consumer demand trends, and complaints of consumers). The study presented focal farmers as the core actor having the highest in-degree centrality of 71% suggesting the level of request for information about innovations that exist in the innovations system from other local farmers. This reflects the strongest ties in the innovation system which relates farmer to focal farmer in the system.

Moreover, the study further revealed that focal farmers, extension agents, and Crop Research Institute (CRI) had the same out-degree measure of 0.57 translating to 57.14%. This result highlights the key role these three actors play in the introduction of technological innovations in the plantain innovation system in Ghana. Even though the out-degree score of CRI was astounding to the researchers, because CRI is a research-based institution and not into extension delivery of innovations to farmers, their role was justified as a mediator between World Vision International and focal farmers in farmer field trials for new improved varieties in the study area. Hence, their reason for playing the temporary role of extension agents in the study area.

2.8.3 Impact of COVID-19 on Agriculture and Livelihood

COVID-19 pandemic was unprecedented even that hit many countries in both developed and developing countries including Ghana. The impact of this pandemic was sudden and swerve a lot of scientific outcomes or establishments. According to Bordi *et al*. (2021), diversified livelihood strategies serve as a useful mechanism for mitigating many sources of covariant and idiosyncratic risks which include weather shocks and price spikes among others. However, in the case of COVID-19, these mitigation strategies were unsuccessful in their implementation during the outcome of the COVID-19 pandemic. Ragasa *et al*. (2021) evaluated changes in household income, food consumption, and diet quality in urban and rural areas of Ghana during the COVID-19 crisis. The survey was done over the phone and interviewed 423 urban consumers in Accra and

369 small-scale crop and fish farmers in rural areas in six regions in middle and southern Ghana. It was revealed in their study that due to business closures and lower sales from trading enterprises, there has been about an 83 percent reduction in income of the urban households interviewed in Accra. Even though, most households showed resilience to food consumption thus, maintaining their pre-COVID-19 level of food consumption.

Meanwhile, about 9 percent of urban consumers interviewed in Accra declared a reduction in food consumption to cope with income loss due to COVID-19. The outcome of the respondents interviewed from the rural areas in middle and southern Ghana showed a 76 percent reduction in income and an adverse impact on livelihood. The study reported that 34 percent of the farmers interviewed in the rural area had a challenge in marketing or selling their produce after harvesting and about 43 percent of these farmers who were crop farmers explained their inability to access farm inputs such as agrochemicals and fertilizers during the outbreak of the COVID-19.

Furthermore, Bordi *et al*. (2021) conducted an impact assessment study evaluating the impact of the COVID-19 pandemic on the livelihood of rural people. Due to the heterogeneity of COVID-19 impact, food security and vulnerability of the rural people were the key focus of the study. The result highlighted the impacts of the COVID-19 pandemic across three livelihoods domains in rural areas. These domains were income, agricultural production, coping strategies, and food security. For the income domain, the result presented the median value of wage income, remittances, non-farm, and on-farm income losses. Relevant to this study, the result presented by Bordi *et al*. (2021) from the World Bank High-Frequency Dashboard data on income loss revealed that 74 percent of the rural households had a loss in farm income due to COVID-19 as compared to 71 percent of households in urban areas. This resulted in about a 77 percent reduction in farm income associated with the traditional food system. This finding is so worrying because even

before COVID-19, a slight reduction in income often leads to deleterious impacts on households' access to nutritious diets which mostly affects their food security status. Reduction in farm income is a clear indicator showing a reduction in demand for farm produce and prices volatility as a result of Covid-19.

Bordi *et al*. (2021) went on to say that for a labour-intensive production system like fruits and vegetables, a high-income elasticity of demand could be more susceptible to the negative income effects and mobility constraints resulting from the virus's containment efforts. For instance, Salazar *et al*. (2020) reported that about 40 percent of farmers living in places like Argentina, Bolivia, and Paraguay reveal a loss in demand for farm products, contributing to a dip in overall sales, with 67 percent of these farmers citing a lower sale price for their products than planned. In general, the COVID-19 pandemic resulted in losses in farm income because of disruptions in output and input markets, price instability, and labor supply constraints (Bordi *et al*., 2021; Salazar *et al*., 2020).

Moreover, supply chains for farm inputs, including seeds, fertilizers, and agrochemicals necessary for the efficient and effective operation of a farm business also experienced disruptions as a result of the pandemic. Some of the measures enacted during the COVID-19 such as mobility restrictions and closure of borders both in-land and air led to the untimely distribution of inputs within and across countries. These disruptions affected productive capacity. The outcome from a review of about 16 survey-based studies by Bordi *et al*. (2021), throws more light on the impact of COVID-19 on productive capacity. The range of these adverse effects ranges from about 3 percent of households in Zambia to 82 percent in Somalia. Aside from the 3 percent farm households that reported the impact on the capacity in Zambia, about 49 percent explained their challenges with respect to the marketing of their produce.

Finally, Bordi *et al*. (2021) also reported on the impact of COVID-19 associated with access, availability, utilization, and stability of the food, the four dimensions of food security. Indicators (Access to any staple food, without eating for a whole day, Hungry but did not eat, ate only a few kinds of foods, and Unable to eat healthy/nutritious food) presented in the report revealed that there has been a reduction in access, quantity, and quality of food consumed during the COVID-19 pandemic due to its shocks. Even though rural people frequently adopt diversified livelihoods strategies to augment incomes and reduce consumption risks associated with primary agricultural production, most of their coping strategies were limited as compared to those in urban areas (Davis *et al*., 2017; Barrett *et al*., 2001)

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The theoretical and conceptual frameworks, as well as the methods of analysis and data collection, are all covered in this chapter of the study. The chapter ends with a brief description of the study area.

3.2 Theoretical Framework

3.2.1 Random Utility Theory

The theory of random utility is a model for social and economic behaviour that can be used to predict outcomes. Random utility theory was founded mostly on the notion of human choice behaviour analysis, according to Hongbete (2017) and Adamowicz *et al*. (1998). The assumption that underlines this theory says that farmers are rational people and will possibly rank alternative marketing outlets with respect to the utility they derive. This theory hypothesizes the existence of a "latent" decision for the utility to be derived in an individual's mind which is unknown and unobservable to researchers (McFadden, 1976; McFadden, 1986). That is, an individual presented with different choice alternatives will choose a particular one that maximizes his/her levels of utility (satisfaction) of which this utility can never be identified with certainty by researchers. Few documentaries observed in the literature on consumer sovereignty posits that an individual's spending behaviour (choices) in markets sufficiently signals his/her preferences for the goods available in the market however, the reasons underlying his/her choices are unknown. This provides a reason for an individual's utility relative to each choice alternative to be called latent (Mitchell & Carson, 1989; Hongbete, 2017).

The random utility theory exposition on the latent utility of an individual is categorized into two components. These include (i) a systematic (observed) component, and (ii) a random or stochastic (unobserved) component (Hanley *et al*., 1998; Louviere *et al*., 2010). The systematic component is also termed deterministic component which reflects the attributes of the good to be selected taking into consideration the individuals' specific variables which is capable of drawing an individual's choice level. On the other hand, the stochastic or the random segment of the latent utility suggests that the researcher is uncertain about individual choices and that these choices are influenced by a wide range of unknown circumstances (Do & Bennett, 2009; Hongbete, 2017; Hensher *et al*., 2005). Additionally, the principle that underpins random utility theory is summarized by the equation (1) one below (Adamowicz *et al*., 1998; Louviere *et al*., 2010; Westerberg et al., 2010):

$$U_{in} = V_{in} + \varepsilon_{in} \quad \text{..........(1)}$$

where U_{in} = true but latent utility related to an individual *n* choice alternative *i*,

V_{in} = individual *n* is linked to the deterministic component of utility when it comes to making decision *i*, and ε_{in} = stochastic component associated with an alternate solution *i* and individual *n*.

The random utility model (RUM), postulates that an individual *n* only has the probability of choosing alternative *i*, which can be predicted by researchers, but not specifically the exact choice alternative to be chosen by the individual. This is a result of the existence of the stochastic component of utility present in the model (Louviere *et al*., 2010). Also, this reflects the RUM's stochastic component, which only permits the researcher to make probabilistic claims about how people choose. According to Louviere *et al*. (2000) and Adamowicz *et al*. (1998), RUT is the theoretical foundation for most types of probabilistic discrete choice models, which were created

to forecast an individual's preferences for goods based on their stated choices. Thus, the probabilistic discrete choice model can be specified as:

$P(i|C_n) = P[(V_{in} + \varepsilon_{in}) > (V_{jn} + \varepsilon_{jn})] \; \forall \; j \in C_n$ ……………………………………………………..(2)

This means that the likelihood of an individual (say a farmer) n choosing alternative i over any other alternative j (J = 1,2, 3) from the choice set C_n equals to the likelihood of the true utility (V_{in} + ε_{in}) which is obtained by individual n when choosing alternative i subject to its true utility (V_{jn} + ε_{jn}) with respect any other alternative j belonging to C_n.

3.3 Conceptual Framework

Figure 4 depicts the conceptual framework adapted from Ghosh-Jerath *et al.* (2022) together with relevant information synthesized from Meester & Ooijens (2020) and Aduhene & Osei-Assibey (2021) which reflects the impact of COVID-19 on the various sections of the value chain and its actors which invariably affected their profit earned. It was captured by Ghosh-Jerath *et al.* (2022) that COVID-19 influenced and disrupted the activities of the value chain actors which from the production side include disruption of farm input accessibility, unreliable market, low or uncertain prices for farm produce and panic-harvesting to avert heavy losses while distribution side suffered limited transport logistics, disruption of informal markets and high transportation cost among others. Processors also were heavily affected by limited number of cargo planes and containers at the air and sea ports respectively and limited labour which jointly reduced the volume of processed mango for sale in domestic and export market. Additionally, the implications of COVID-19 affected market information dissemination and slowed down economic activities which made some workers to be laid off thus, suddenly pressuring their income which resulted in adoption of livelihood strategies skewed towards consumption of staple food to sustain the household. These

factors that came to light as a result of COVID-19 and its implication imposed burdened mango value chain actors and their profit earned.

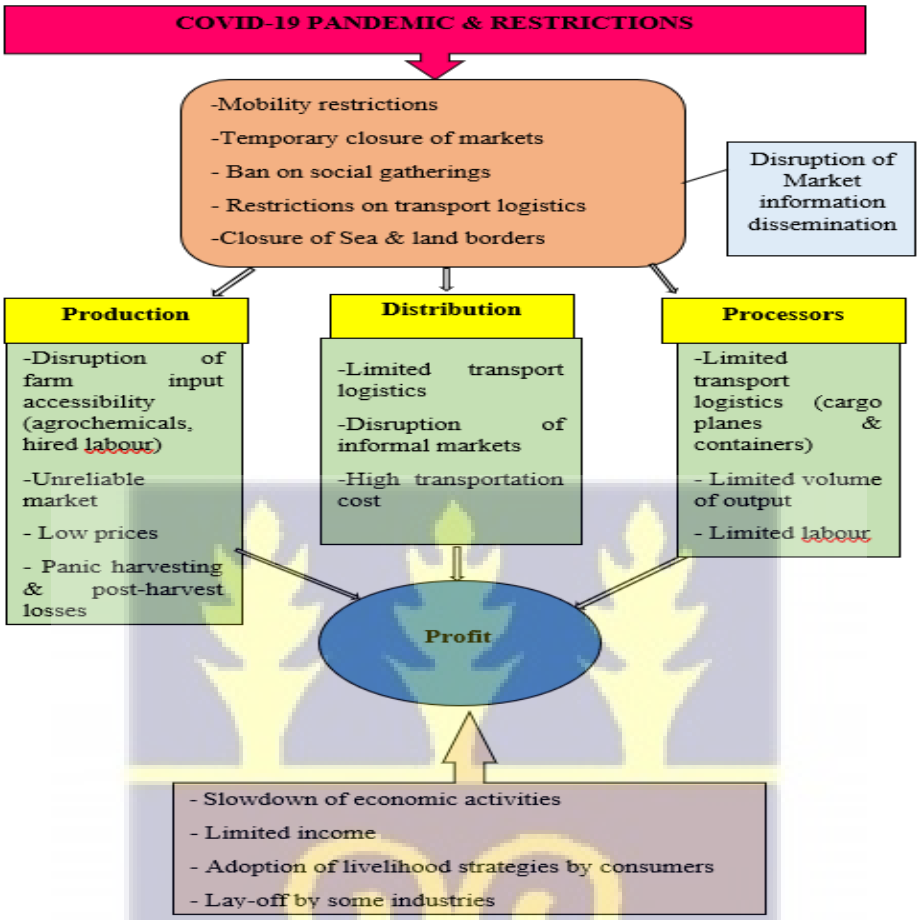


Figure 4: Conceptual Framework

Source: Adapted from Ghosh-Jerath *et al.* (2022)

3.4 Assessing the Governance Structure Along the Value Chain

The study employed the scoring exercise used by Kaplinsky & Morris (2001) on some selected variables which could make an actor exercise "*importance*" and "*influence*". The variables of interest include profit, bargaining power and information concentration. According to Clottey (2014), "*importance*" is analyzed as actor's ability to exercise great effect and influence within the chain, while "*influence*" refers to the power that an actor possesses in exerting control and effect

on other actors present in the chain. The mean score of all the actors in question such as producers, distributors and processors were calculated of which each total score amount to 100%. The score reflects the strength of the variable for each of the actor. This implies that the higher the score (%), the higher the level of importance and influence the actor carries within the chain. Thus, the actor with the highest score is considered as the dominant actor along the mango value chain. The key elements considered for the governance structure are profit, bargaining power and information concentration. A higher score for the variables as perceived by the other actors reveal their importance and influence within the value chain.

3.5 Analytical Perspectives

3.5.1 The Social Network Analysis (SNA)

Social Network Analysis is made up of a theoretical perspective and a set of analytical tools or methods. The theoretical perspective explains how the interactions of individual autonomous actors create the social structures of community and the former analyze those interactions and social structures as networks of nodes (actors) and ties (relationships) (Dempwolf & Lyles, 2012). The set of analytical aspects of the SNA helps to better understand connections among people, organizations, or other units of analysis (Patterson, 2016). According to Butts (2008), the social network field is an interdisciplinary research subject that aims to anticipate the structure of social links and interactions, as well as the impact of that structure on other social phenomena. The application of these techniques (also known as social network analysis methods) comprises a wide range of functional domains, from the analysis of notions like mental models (Wegner, 1995; Carley, 1997) to the study of international conflicts (war) (Wimmer & Min, 2006).

Social Network Analysis (SNA) is a powerful technique in psychology that may be used to model and characterize the relational environment in which behaviour occurs. SNA can be used to

investigate developmental phenomena like individual life histories and 'intrapersonal' networks (Butts & Pixley, 2004). More recently, there has been a dramatic surge in the study of networks across several disciplines due to its uniqueness in theorizing about and systematically analyzing the competing forces of individual agency and structural social forces. This has caused a shift towards the use of large data set from available affiliation (Newman, 2003; Dempwolf & Lyles, 2012). This has enabled the systematic analysis of more multifaceted networks of all kinds.

Newman(2003) identified four "loose categories" of network analysis in the study of the structure and function of complex networks, including; (1) social networks, such as forms of contact or interaction between individuals; (2) information networks, such as links on the World Wide Web and academic citation networks; (3) technological networks, such as water, transportation, and energy systems; and (4) biological networks, such as food webs with predators, prey, and predators; and (5) biological networks, such as food webs with predators (2003, 5). All four approaches have a shared empirical focus on relational structure as well as a set of mathematical analyses in common. A network is a complex structure made up of variables represented by nodes and edges (connections) between them. In some publications, nodes are denoted as vertices, edges are referred to as links, and networks are discussed as graphs (Hevey, 2018). Food security, income, food availability, unemployment, and poverty, for example, are nodes in the network, with positive and negative relationships between them serving as edges.

To better understand the relationships between the individuals in the mango value chain, this study used Social Network Analysis (SNA). Several methods for measuring, visualizing, and simulating relationships among actors, as well as mathematical analysis of these relationships are included in the Social Network Analytical tools (Ouko, 2016). Butts (2008) defines the social network field

as an interdisciplinary research subject that aims to predict the structure of social links and interactions, as well as the impact of that structure on other social phenomena.

In addition, Williams & Hummelbrunner (2011) defined a social network as a collection of actors linked by some kind of relationship. Individuals, groups, and organizations can all be included in these lists of actors. Depending on the type of network under investigation, the relationships might take many different shapes (communication ties, access to resources like credit, power relations, and membership ties). Social network analysis is used to describe a particular actor's participation in an event or a programmme. The network analysis technique can be applied to cross-sectional or longitudinal time-series data. Group-level or individual-level networks can be examined using the network analysis technique. Cross-sectional data from a group can reveal the position and group-level conditional independence relationships among the actors (e.g. Rhemtulla *et al*.,2016). Individualized networks built on time series data can reveal information about a specific group over time (e.g. Kroeze *et al*., 2017). In addition, network analysis encompasses a diverse set of analytical approaches for analyzing various network models.

To obtain information on individual-specific social networks for this study, each actor was asked where he or she gets market information from and also mention two other persons who give him or her information on market information. For example, a farmer was asked to name where he gets his market information from and to mention two other persons to whom he or she receives information concerning agricultural marketing activities. Also, focus group discussions and on-phone interviews were conducted for the data collection for this study. These approaches were used by Rogers (2003) and are described as the sociometric method to measure network links and interactions. This approach was established by Coleman (1994) and has been used by several network analysts including Conley & Udry (2001) and Onumah *et al*. (2021) who applied it to the

adoption of pineapples in Ghana and the agricultural innovation system for establishing a cocoa innovation platform in Ghana respectively. One of the main reasons for limiting a farmer to mentioning only two people is that he or she may name the two most powerful network members. This allows analysts to acquire a detailed image of each network. However, other analysts believe that the farmer will most likely share important information that leads to access to market data with a network partner who is further away (Rogers, 2003; Santos & Barrett, 2004). Allowing a farmer to name an unlimited number of network members and then distinguishing between strong and weak relationships can solve this problem (Matuschke & Qaim, 2009).

In general, society is viewed as a network of interpersonal ties rather than a collection of individuals and their characteristics. As a result, the primary focus is on actor connections as well as their characteristics. Individuals' behaviours concerning their social systems are described in this way (Williams & Hummelbrunner, 2011; Ouko, 2016). Three different SNA tools were used. A relational matrix was created to represent information about specific interactions between farmers and other actors. The relationships were visualized with the help of the UCINET software.

Finally, centrality indicators such as network destiny, betweenness centrality, and degree centrality, were used to assess the network structure. Network density (D) is a proportion of all possible connections in a network that calculates the number of actors that are related to other actors in the network. In network analysis, the number of ties an actor has with other members is expressed as a percentage of the total number of connections in the network (Onumah *et al*., 2021). Degree centrality, according to Speilman *et al*. (2010), is the number of direct relationships (ties) that an actor (node) has with others, and hence it is a measure of activity.

When the score of each of these measures is higher, it reflects how connected the actor is in the network; this shows how influential or prominent they are in the credit and or productive resource

access system. The in-degree measure simply reflects how many interactions an actor has with other actors, as well as a measure of that actor's network significance. The out-degree, on the other hand, assesses how well actors can connect to other network members (Borgatti *et al*. 2009). Farmers, for example, may have a high in-degree score but a lower out-degree score because they are frequently the recipients of encounters. As a result, an actor is regarded influential when his or her out-degree is higher (Onumah *et al*., 2021; Borgatti *et al*. 2009).

Betweenness centrality, as defined by Wasserman & Faust (1994), is the number of times an actor (node) functions as a bridge along the shortest path between two other players.

The average distance between an actor and the rest of the network is calculated using *closeness centrality*. It demonstrates an actor's accessibility to credit resources and relative autonomy in the value chain. As shown in equations 1 to 5, the centrality measures were defined by Freeman (1979) and adopted by Lada (2013). The UCINET software was employed in analyzing the data.

(i) *Network density* (D),

$$D = \frac{\lambda}{\frac{N(N-\lambda)}{2}} \quad \text{..... (3)}$$

(ii) *The degree centrality*: $= C_d(n_i) = \lambda_i(n_i) / (N-1)$ .....(4)

(iii) where *ni* denotes the *ith* actor(node) in the network, $\lambda i(ni)$ denotes the number of connections (ties) to *ni*, and *N - 1* represents the size of the network less the actor of interest.

(iv) *Betweenness centrality*:

$$C_B(i) = \sum_{h<k} f_{hm}(i) / f_{hm} \quad \text{..... (5)}$$

normalized as:

$C_B(i) = C_B(i)/[\frac{(n-1)(n-2)}{2}]$ ..... (6)

Where,

$C_B(i)$ = the betweenness centrality of the individual actor;

g_{jk} = the number of geodesics connecting jk;

$g_{jk}(i)$ = the number of geodesics that actor i is on;

[(n-1)(n-2)/2] = number of pairs of vertices including the vertex itself

(i) *Closeness centrality*:

$C_B(i) = [\sum_{h=i}^{N} d(i,h)]^{-1}$ ..... (7)

normalized as:

$C_C(i) = (C_C(i))/(N-1)$..... (8)

Where, $C_c(i)$ = the closeness centrality of the individual actor

d = the average shortest path between a vertex and all vertices in the graph

3.5.2 Nature and Contribution of SNA in Access to Market Information

Among several functions that the social network analysis performs, the SNA provides the centrality measures (degree centrality, closeness, and betweenness), visualization, and manipulation of network data (in adjacency matrix form), (Brandes *et al.*, 2003) and evaluates positions and roles of actors. The social networks illustrate the flow of market information among the various actors along the mango value chain. A detailed description of the social networks that exist between the actors in the mango value chain system will enhance an understanding of which actors have more control over others and which actors form bridges in the network (Onumah *et al.*, 2021). Analyzing social networks in significant detail will help policymakers better

comprehend social learning in the context of market information availability and devise more targeted measures to improve mango value chain systems (Maitra *et al*., 2014). A major challenge noted by Magesa *et al*. (2014) in developing policy is disseminating market information related to agricultural activities including activities that exist within the value chain systems. Their study revealed that this challenge limits the activities of many actors along the value chain hence impeding the performance of the value chain system.

Okten & Osili (2004) and Mwakaje (2010) stated that access to market information and technical support will potentially enhance the productivity and efficiency of value chain actors. There are several sources to obtain relevant information, credit, and productive resources for the improvement of production, efficiency, and welfare of value chain actors but the few sources obtained from literature include; input dealers, farmer groups, MoFA, GSA, and GEPA. These resource agencies are referred to as the actors/events. These actors provide other value chain actors (Non-FBO farmers, small-scale processors, commercial processors, wholesalers, and retailers) the necessary market information to ensure the efficient operation of the value chain system. SNA is a set of representational tools that aid in the analysis of social relationships and demonstrates the significance of various linkages or connections that influence behaviour, information, and resource transfer among the actors (Williams & Hummelbrunner, 2011).

3.5.3 Multinomial Logit Model

The multinomial logistic regression model is suitable for analysing data to determine the likelihood of a certain event occurring or to predict the likelihood of a specific event occurring in the presence of relevant explanatory variables. Gujarati (1992) and Tedasse (2011) explained that with explanatory variables, multinomial logistic regression predicts the probability of occurrence of the event under study but does not necessarily determine a numerical value for the dependent variable.

Dougherty (1992) explained that the multinomial logistic regression and binary logistic regression models are very similar in terms of formulation. While binary logistic regression uses only two categories as a dependent variable (dichotomous variable), multinomial logistic regression uses more than two categories (polytomous).

As a result, multinomial logistic regression is a binary logistic regression extension. Mohammed & Ortmann (2005) explained that the relationship between dependent and independent variables can be analyzed using several analytical techniques such as linear regression models, probit analysis, log-linear regression, and discriminant analysis in their study on the factors influencing the adoption of livestock insurance by commercial dairy farmers in Eritrea. However, the choice of multinomial logistic regression model for this study is because of its usefulness and advantages, especially when analysing qualitative dependent variables.

Although the Linear regression model (also known as Ordinary least squares regression (OLS)) was employed and recorded by various analysts (Montshwe, 2006), Gujarati (1992) penned that the method only becomes useful when the dependent variable is quantitative and not qualitative as in the case of this study. Thus, the OLS is inapplicable in this study because the probability has to fall within 0 and 1, especially if there are no restrictions on the values of the various independent variables. In addition, Gujarati (1992) elucidated that multinomial logistic regression gives the estimates from the logit model which always has its logical bounds between 0 and 1. Also, its mathematical simplicity and its ability to model can be used to analyse multi-category dependent variables which takes independence across the choices and disregards correlation or substitution between these variables (Win *et al*., 2015).

Multinomial logistic regression is effective in categorical data analysis because it predicts the location of a dependent variable based on many independent variables. In terms of scale, the

independent variables might be dichotomous (binary) or continuous (interval or ratio). Multinomial logistic regression is a straightforward expansion of binary logistic regression that allows for more than two dependent variable categories. Multinomial logistic regression, like binary logistic regression, evaluates the probability of category membership using maximum likelihood estimation. Multinomial logistic regression necessitates careful consideration of sample size and outlying event examination. It should include univariate, bivariate, and multivariate assessments. Simple correlations between the independent variables should be used to assess multicollinearity. Multivariate diagnostics can also be used to check for multivariate outliers as well as to rule out outliers or influential examples. Because it does not assume normality, linearity, or homoscedasticity, multinomial logistic regression is a popular analysis.

The multinomial logit models have their grounds on the random utility theory. The random utility theory as discussed in *Activity 3.2.1* states that the selection of an alternative from among a set of alternatives by a household suggests that the utility derived by the household from the selected alternative is greater than the utility derived from the unselected alternative. Vojáek & Pecáková (2010) provides a list of options for the household to pick from. According to Temesgen *et al*. (2017), Addisu (2016), and Honja *et al*. (2017) value chain actors including producers, distributors, and processors choice of market outlet is linked to the willingness to maximize profit and could be influenced by socioeconomic, institutional, production and market-related variables. The main goal of this study is to better understand the significant elements that influence producer, distributor, and processor selection.

To examine the factors influencing the choice of mango marketing outlet in southern Ghana, the multinomial Logit model was used. The outlets identified were local market, export, and processor market for producers; other retailers, direct consumers and small-scale processors for distributors

and export market, supermarket and direct consumers for processors. Upon careful considerations and observation on the field, the study observed most of these outlets are mutually exclusive of the other. The MNL technique is used to predict multi-category dependent variables. It implies independence across options and does not allow for correlation or substitution (Koch, 2015). As a result, the likelihood of marketing outlet selection techniques among mango producers, distributors, and processors is illustrated below:

$$Prob = (Y_i = t) = \frac{esp(\beta\prime_t X_i)}{\sum_{t=1}^{3} esp(\beta\prime_t X_i)} \text{ for t=1,2,3 ....} \quad (9)$$

Where Y_i is the probability of mango actor, say farmers choose market t, Pr(Y_i = j).

Market t: 1 means selling to the local market, 2 means selling to the export market, and 3 means selling directly to the processors. x_i is the vector of household, production, and marketing variables β_j is the vector of coefficients associated with the market choice t.

The log-odds score is considered as follows:

$$In \frac{P_{ij}}{P_{ik}} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_k X_k + e_i \quad (10)$$

P_{ij} *and* P_{ik} represent the likelihood that an actor (producers, distributors, and processors) will choose one outlet over another. The natural log of the probability of choice *j* relative to the probability of choice P_{ij}/P_{ik} an independent, normally distributed error component with a mean zero, and k is a constant. X is a matrix of parameters that reflect the impact of changes in X on the likelihood of picking a specific outlet.

The equation (10) is simplified below:

$In\frac{P_{ij}}{P_{ik}} = \alpha + \beta_1$(High cost of inputs) + β_2(higher output price) + ……+ β_k (Ownership of transport facility) + e_i

High cost of inputs, higher output price, reliable customers, the volume of produce or product, own transport among others are the X_1 to X_k are factors affecting the choice of a market outlet while β are parameters to be estimated and e is a randomized error. The probability of selecting outlet j from a set of j alternatives is given by:

$$Prob\ (Y_i = t) = \frac{e_{zt}}{\sum_{k=0}^{t} e_{zt}} \quad \text{…….. (11)}$$

Where Z_t is a choice (local market = 0, export market=1, and supermarket = 3) and Z_t is a choice that could be chosen (Greene, 2009). The model estimates are used to calculate the likelihood of selecting a market outlet based on j variables. Xi has a variety of different options.

Marketing outlets are:

For **producers -** local market = 0, export market =1, processors market = 2. The Local market is defined as the base outcome.

For this study, factors examined to influence producers' decisions for the choice of marketing outlet are the cost of farm inputs, unit price(s), the quantity of mango produced, higher output price, reliable customers, membership of FBO including socio-demographics of the respondents.

Distributors – Other retailers' market =0, Small-scale processors market=1, Direct consumer market =2). The other retailers' market is defined as the base outcome or the reference group.

The explanatory variables examined are members of cooperatives, reliable customers, higher price, number of buyers, ownership of transport, value addition, and unit price in Ghana cedis as well as

the socio-demographics of the distributor (respondent). In a study by Bongiwe *et al*. (2012) discussed marketing outlets like NAMBoard and Non-wholesalers with the reference category of the other-retailers market outlet. In the same manner, this study categorized other retailers as a reference or base outcome.

Processors – Direct consumer market = 0, export market=1, supermarkets = 2. The reference outcome is the direct consumer.

The Multinomial Logit model's parameter estimates simply show the direction of the independent variable's effect on the dependent (response) variable; they don't provide the actual degree of chance or probability. The marginal effects, also known as marginal probabilities, are functions of probability that measure the variation in the chance of making a specific option in response to a unit change in an independent variable from the mean (Green, 2000).

For easy identification, *Table 1* outlined the various actors and the possible outlets they use as identified from literature and observed on the field.

Table 1: Actors and Their Possible Market Outlets

Actor	***Producers***	***Distributors***	***Processors***
Outlets	Local Market	Other Retailers	Direct consumers
	Export market	Small-scale processors	Export market
	Processor market	Direct consumer	Supermarkets
Reference group	Local market	Other retailers	Direct consumers

Source: Survey data, 2021

For this study, three major mango market outlets were identified as alternatives to mango producers (farmers). These include the local market, private processing factories, and exporters.

The local market comprises wholesalers and retailers. For distributors, they explore other retailers, small-scale processors, and direct consumer market outlets. The study used other retailers as base outcomes or reference groups for distributors. Mango processors sell their mango products to direct consumers (reference group), export markets, and supermarkets.

3.5.4 Difference in Difference Model

In impact evaluation studies, difference-in-difference is a tool for estimating the impacts of a sudden change in the economic environment, policy, or general treatment on a group of people. The difference in outcomes after and before an intervention is examined for intervention-affected and unaffected groups. Ordinary Least Squares (OLS) in repeated cross-sections (or a panel) of data on individuals in treatment and control groups for several years before and after a given intervention are most commonly used to calculate difference-in-differences estimates and their standard errors.

The study by Fredriksson & Oliveira (2019) has made difference in difference estimation simpler in assessing the outcomes observed for two groups for two time periods. For this estimation, one of the groups was subjected to a treatment in the second period but not in the first period. Meanwhile, the second group has no treatment in either period. According to Yamano & Jayne (2004), the difference between average gain in the control and treatment groups is determined, in situations when the same units are observed within a group during each period. In other words, the second (control) group's average gain is subtracted from the first (treatment) group's average gain. This removes biases in the second period resulting from comparisons between the treatment and control groups, which could be due to long-term differences between the two groups. It also eliminates trends-related biases in treatment group comparisons over time.

For this study, the Eastern and Volta region were taken as the control group since the intensity of the spread of the COVID-19 virus was not high as compared to the Greater Accra region (Treated group) which was hit seriously and hence affected by three weeks lockdown. During the lockdown, there were certain restrictions such as a ban on social gatherings or events, travel restrictions, and movement which led to the closure of Ghana's seas, land and air borders among others. These measures continued even after the three weeks lockdown and were keenly followed across the country with the help of government security services like the Ghana Police Service, especially in the Greater Accra metropolis. These restrictions with its menace on marketing activities such as demand shocks, supply shocks, financial shocks, and continued uncertainty made value chain actors (producers, distributors, and processors) change their various marketing outlets to sell out their products or products to avoid losses (GSS, 2020; Owusu, 2021). This switch in the marketing outlets employed led to a change in profit earned during the COVID-19 as compared to pre-COVID-19 profit.

Ordinary Least Squares (OLS) is used to examine the difference in difference estimates and associated standard errors. Before and during the COVID-19 epidemic, this was done in a cross-sectional (or panel) survey of people in control (2019) and treatment groups (2020). For repeated cross-sectional data, and assuming A is the control group, we can write the model for a standard member of any of the groups as

$$y = \alpha_0 + \alpha_1 dQ + \lambda_0 d2 + \lambda_1 d2*dQ + u \quad \text{..... (12)}$$

where y is the variable of interest (Profit) and $d2$ is a dummy variable for the second period. Before the policy change, the dummy variable dQ represents possible disparities between the treatment and control groups. Even in the absence of the change or the Covid-19 shocks, the time period dummy, d2, represents aggregate elements that might induce changes in y. The coefficient of

interest, 1, multiplies the interaction term, *d2*dQ*. For observations in the treatment group in the second period, this represents a dummy variable equal to one. The estimate for difference-in-differences is $\lambda 1$ (Yamano & Jayne, 2004).

The difference-in-differences estimator could be calculated by taking the difference in one outcome before (t = 0) and after (t = 1) the outbreak of the COVID-19 pandemic within the treatment group e.g. $E(\Delta Y_{Treat}) = E(Y_{Treat1}) - R(Y_{Treat\ 0})$.

To avoid choosing unrelated trends or COVID-19 effects, the study estimated the difference in results within the control group over time and the difference-in-differences between the two groups (Yamano & Jayne, 2004). These calculations remove the existence of unrelated trends in the model estimation as represented mathematically below:

$$E(DID) = [E(Y_{Treat1}) - E(Y_{Treat0})] - [E(Y_{Control1}) - E(Y_{Control0})] = E(\Delta Y_{Treat}) - E(\Delta Y_{Control}) \ldots (13)$$

The variable of interest for the difference in difference model was profit generated by the various actors (producers, distributors, and processors). The profit was calculated by subtracting the total cost of production from the total revenue generated. This is illustrated mathematically below:

Profit (NFI) = Total Revenue (TR) – Total Cost (TC) …… (14)

Where Total Cost = Total Fixed Cost (TFC) + Total Variable Cost (TVC)

Variable cost elements such as cost of fertilizer and pesticides, labour, transportation among others.

Fixed cost elements include; rental cost of land, depreciated value of (cutlass, spraying machine, pruning saw, pickaxe, crates, boxes, processing machine among others).

The fixed cost elements were depreciated using the straight-line depreciation method. The formula is given as $Depreciation = \frac{Original\ cost - Salvage\ value}{Expected\ useful\ life}$ ..... (15)

The profit of actors like mango producers was log-transformed to ensure to enable linearity between the dependent and independent variable hence, improving the the validity of the result. Unlike the Gross Margin analysis, the NFI method includes depreciation of the fixed components. The straight-line depreciation method was employed to determine the economic loss in the market value of the capital assets. Economic loss can be attributed to obsolescence and wear or tear.

Also, the study used a T-test to examine the difference in mean of the profit generated by the various actors.

$$t = \frac{\mu_1 - \mu_2}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}} \quad \text{..... (16)}$$

Where μ_1 and μ_2 are the mean of the profit for the actor categories, for example, mango producer

σ^2_1 and σ^2_2 are the sample variances for the actor categories

N_1 and N_2 are the sample sizes for the actor categories

Statement of Hypotheses

Null Hypothesis (H_o) and Alternate Hypothesis (H_a)

Producers, Distributors and Processors

H_o: $\beta_1 = \beta_2$

H_a: $\beta_1 \neq \beta_2$

Using the formula above, a t-test will be calculated on the mean of profit earned both in 2019 and 2020. This is to test for the significant difference in the profit generated in both years. The hypothesis for this test is stated below:

H_o: There is no significant difference between the profit for 2019 (β_1) and 2020 (β_2) for mango producers.

H_a: There is a significant difference between the profit for 2019 (β_1) and 2020 (β_2) for mango producers.

A similar hypothesis applied to other actors like distributors and processors.

3.5.5 Description and Justification for Inclusion of the Independent Variables

3.5.5.1 Household Characteristics

Age: It is a categorial variable and has been measured in years. The age of the respondents is expected to have a positive correlation with the choice of a specific marketing outlet by the value chain actors considered for this study. For example, it is expected that as age increases mango producers will tend to sell to a specific market outlet that maximizes their utility (Mmbando, 2014). Shiimi *et al*. (2012) discovered that age is positively connected with the decision to sell or not sell to a given marketing channel among cattle farmers in North-Central Namibia. Their study pointed out that older value chain actors like the cattle producers might have transact business with many of the marketing outlet have may know which outlet is more beneficial to them than the other. Age is very important in making choices that increases an individual's satisfaction. Age comes with more responsibility hence, as age increases value chain actors like distributors will choose an outlet that makes them earn more profit than the other.

Table 2: Explanatory variables included in the Multinomial logit model

Independent Variables	Description & measurement	Variable Type	Expected sign		
			Producer	Distributor	Processor
Age		Categorical	+	+	+
Gender	Dummy (1 =Male, 0= Female)	Categorical			
Educational background	Number of years	Continuous	+	+	+
High cost of inputs	Dummy (Yes=1, No=0)	Categorical	-	+	+
Unit price in per tons	GHS	Continuous	+	+	+
Higher Output price	Dummy (Yes=1, No=0)	Categorical	+	+	+
Reliable customer	Dummy (Yes=1, No=0)	Categorical	+	+	+
Number of buyers	Dummy (Yes=1, No=0)	Categorical	+	+	+
Own transport	Dummy (Yes=1, No=0)	Categorical	+	+	+
Volume or quantity bought	Quantity in tonnes	continuous		+	+
Farm size	Hectares	continuous	+		
Cooperative/FBO Membership	(1 if Actor is a member of a cooperative; 0 otherwise)	Categorical	+	+	+
Value addition	(1 if Actor adds value to the mango; 0 otherwise)	Categorical		+	+

Source: Author's construct (2021)

Gender: The gender of the respondents is a dummy variable where males were coded as 1 and females 0 (Wosene *et al*., 2018). Gender is expected to positively influence the choice of a market outlet by the actors along the mango value chain (Producers, Distributors, and Processors). Male

mango producers as revealed by Xaba & Masuku (2013), have better access to marketing information and productive resources necessary to meet the various quality requirements for a sustainable marketing channel than female farmers. For instance, most male mango producers have the largest farms and belong to farm cooperatives or FBO where relevant information are shared and also have access to outlets that could increase their profit (Woldesenbet, 2013). Hence, gender could possibly influence the decision of the mango value chain actors in their choice of marketing outlet.

Education. Education was measured as a dummy variable. It is expected that a high level of education will positively influence the choice of the value chain actors considered. This is because these actors can gather and understand production and marketing information so that they can adjust their production and marketing systems according to the different market demands hence, can be good negotiators.

Farmers with greater education, for example, are better negotiators and risk-averse as documented by Zivenge & Karavina (2012). In Malawi and Ethiopia, Chirwa (2009) and Anteneh *et al*. (2011) found that the level of education of value chain players (farmers) has a substantial impact on smallholder farmers' market channel choice. This suggest that education has a key role in influencing the decision to choose the best option among other alternatives.

High Cost of Inputs: High cost of inputs was measured as a dummy variable. It is expected that due to the higher cost of inputs value chain actor like producers for example, will switch to sell to a market outlet that will maximize their utility to cover up for the cost involved in production. Since mango value chain is both capital and labour intensive to ensure its effective running and comes with so much cost thus, it will be very necessary for many of the actors in the chain to choose the best outlet that helps in minimizing their cost.

Unit price: The unit price of the mango in both 2019 and 2020 was measured as a continuous variable (Martey *et al*., 2012). The unit price of a kilogram of mango changes at times with year due to the seasonality of the fruit. When the season fails some mango producers, the price of the fruit changes since it becomes scarce to buy. With this, this study sought to find whether the price offered in particular influences the choice of the producers. The selling price was expressed in Ghana cedis and was determined by the mango market channel (S). For their best benefit, the value chain actors evaluated the price of mango, which influenced their market outlet selection. This is in agreement with Tadesse (2011), who found a positive association between avocado price and the amount provided to the market, which was significant at 10%.

Higher Output Price: Higher output price was measured as a dummy variable. Mmbando (2014) asserted that higher output price provides an incentive to the selling point. It is therefore expected that when the price of the mango fruit/product increases, the actors (producers, distributors, and processors) will tend to sell to outlets that maximize utility. For example, producers will choose to sell to processors since they offer a higher price and buy in large volumes. Smallholder farmers in Ghana selected market outlets based on product price, according to Martey *et al*. (2012). They established that whether a rural or an urban market was chosen was controlled by the price of output.

Reliable customers: Reliable customers were measured as a dummy variable. Respondents who choose yes for agreeing that reliable customer influences their choice of the market outlet were assigned one while those who choose No were assigned zero. It was expected that regular customer relations will positively influence the choice of marketing out of the mango producers, distributors, and processors.

Number of buyers: It was expected that a large number of buyers of the mango product will positively influence the outlet choice of the mango producers, distributors, and processors. As such, the number of buyers was a dummy variable. Those who agree that number of buyers influences their choice of a specific marketing outlet took Yes and were assigned one (1) while those who disagreed took No and were also assigned zero (0).

Ownership of transport assets: Ownership of transport was expected to influence the choice of the local market, processors, and. This is because mango producers who own transport facilities could supply their products to local market centers and sell to retailers and even directly to consumers by obtaining better prices (Ermias, 2021). According to Melese *et al*. (2018), having on-farm transportation enhances the likelihood of transferring goods to private merchants and retailers in the market.

Volume bought: The quantity or volume of mango purchased could contribute to the decision of who to sell the mango fruit or product to by the mango distributors and processors. Hence, this study expected that the volume of mango fruit or product bought will influence the marketing outlet of the distributors and processors.

Cooperative or FBO membership: The membership of a cooperative helps the respondents like the producers to obtain a fair price for their produce. The executives of the cooperative meet with the key informants of the marketing outlet for instance the sales managers of the private processing firms where the price for a kilogram of mango is determined. This makes it possible for the producers not to be cheated by the processing firms with cheaper prices. Membership in an organization was also used as a proxy for access to information. Members are more likely to participate in a sustainable market channel as a result of accessibility of market information than

non-members (Sidibe, 2005; Xaba & Masuku, 2013). Membership of Cooperative or FBO as dummy where membership is assigned 1 and no membership is assigned 0 (Wosene *et al*., 2018).

Value addition: It was expected that the value addition of the mango product will positively influence the choice market outlet of the mango distributors and processors. It was expected that when these actors add value to the product, the price of the final product will increase and hence influence the specific market outlet ad utility.

Period of Payment: Most sellers expect to receive cash or payment immediately after-sales. Thus, the study expected that buyers that pay for the produce instantly will be the preferred choice of outlet for mango processors and this could be a positive influence on their marketing outlet decision.

3.5.6 Constraints Analysis

Kendal's coefficient of Concordance, Garrett's ranking technique, and direct scoring are the few constraints measuring tools. Studies have shown that Kendall's coefficient of Concordance gives appropriate results in the ranking of the constraints. According to Lewis & Jonson (1971), it is one of the popularly used methods for ranking constraints. The significant test gives the conclusion about the various variables ranked. Kendal's Coefficient of Concordance(W) calculates the degree of agreement among the number of rankers (m) and the number of constraints(n). W is the index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of the sum of ranks. This index finds the sum of each constraint ranked and examines the variability of the sum. A perfect agreement gives a maximum variability among the sum of the constraints (Mattson, 1986). It is a technique that measures constraints from the most pressing one to the least pressing one and then indicates a degree of agreement among the constraints.

Garret's ranking technique gives a weighted scoring on each of the constraints ranked through conversions which makes it easier to interpret. A study conducted by Chalamila & Madulu (2007) in assessing the 'Potential and Constraints of Fruit trees in Coast regions in Tanzania' revealed that major constraints farmers face in the area are lack of reliable market and lack of improved varieties. The constraints ranked were lack of reliable market, lack of improved varieties, lack of processing know-how, and improved production and pest and diseases with their percentage scores as 75%, 50%, 45%, and 30% respectively. They further concluded that pineapple, cashew, and oil palm farming serve as the major source of income for households replacing coconut in the study area.

Deukyirah (2015) used Kendall's coefficient of Concordance in ranking the constraints rice farmers face in the Kassena-Nankanan East District of Ghana and found that pest infestation for conventional method and insect infestation was the most pressing constraints in the study area. Pest infestation had mean scores of 1.64 and 1.94 for conventional method and System of rice Intensification respectively while insect infestation had a mean score of 1.97 and 1.81 for convensional method and system of rice intensification respectively. The Kendall's coefficient of Concordance (W^a) obtained was 0.504 and 0.392 for conversional method and System of rice Intensification respectively indicating 50% and 39% of agreement among the ranking of the constraints.

For this study, some production constraints identified from literature and confirmed through pretesting by respondents were incidence of pest and diseases, high cost of inputs due to COVID-19, unreliable market, low price due to COVID-19, low price due to COVID-19, unavailable storage, inadequate funds for production due to COVID-19 shocks, lack of access to current market information, low yield and unavailable labour due to COVID-19. Post-harvest loss, poor quality

of mango fruit, higher transportation cost, lack of access to credit, reduced demand for mango fruit due to COVID-19, High cost of labour due to COVID-19, unreliable source of mango fruit, lack of market, and poor road network were the various constraints identified to be constraining the marketing activities of distributors.

Moreover, the various factors identified from literature to be affecting processors include poor road network, high cost of inputs due to COVID-19, unreliable source of supply, competition from other processors, high cost of labour due to COVID-19, and reduced demand for processed mango fruit due to COVID-19. The constraints were assigned with the lowest number and the highest number as the most and least pressing constraints respectively. For example, for producers, the constraints were assigned with numbers from 1 to 10 and ranked with the numbers 1 and 10 as the most pressing and least pressing constraints respectively. The respondents were asked to rank from the most pressing to the least pressing constraint.

Below is Kendall's coefficient of concordance formula;

$$W = \frac{[\sum T^2 - (\frac{\sum T^2}{n})}{nm^2(n^2-1)} \quad \ldots\ldots\ldots\ldots \quad (17)$$

where,

W= Kendall's coefficient of concordance

T = sum of ranks for each constraint

m= number of respondents

n= number of constraints ranked

The agreement among the ranking will be tested using the F-test. The F-test is given as

$$F_{cal} = \frac{\frac{[m-1]}{W}}{1-W} \quad \text{..... (18)}$$

Hypothesis

The null hypothesis (H_o) was tested against the alternate hypothesis (H_A)

H_o: there is no significant agreement among the rankings by the respondent

H_A: there is a significant agreement among the ranking by the respondents

Decision rule: Reject H_O in favour of H_A if $F_{cal} > F_{crit}$

3.5.7 Method of Data Collection

Primary data was collected using a well-structured questionnaire from 250 respondents which include 150 farmers, 30 distributors, and 10 producers from each of the regions (Greater Accra, Eastern, and Volta). Secondary data were gathered from workshops, MoFA, GEPA, and published articles, papers, and reports for this study.

3.5.7.1 Sampling Procedure and Sample Size

A multistage sampling procedure was used to select representative households in the study area. In the first stage, Greater Accra, Eastern, and Volta regions were selected purposely since they are among the largest area under mango production in the study zone in Ghana. The second stage of the sampling involved the selection of districts from each region of which at least two communities were selected from each of the districts. The districts include Yilo Krobo District (New Somanya and Akorley), Upper Manya Krobo (Mensah Dawa) and Okere District (Abonse) in the Eastern region, North Tongu (Fodzoku), Kpando Municipal (Kpando and Kudzra), and Ketu North district (Dzodze and Tadzewu) in the Volta region. For the Greater Accra region, only Shai-Osudoku

District was selected since it is the only district dominated by mango producers with a high volume of mango production in the region.

The communities visited in the Greater Accra region were Agomeda, Kongo, and Ayikuma. These communities mentioned above were purposively selected because they fell under communities that majority of its populace are into mango production and distribution (wholesalers and retailers) as identified by the Ministry of Food and Agriculture (MoFA). In the third stage fifty (50) mango producers (farmers) were randomly selected from each region. For farmers to stand the chance of being selected again in the population, the simple random sampling technique was employed. This was based on the use of a random number table. With this, each member of the population was numbered and the preliminary point in the table was determined by randomly dropping a finger on a number. The direction selected to read the numbers was "up to down". The numbers read from the table whose last digit was between 0 and N (total population) were selected until the total sample of 150 was drawn.

Also, random selection technique was employed to select sixty (60) distributors and thirty (30) processors within the regions. This was possible by identifying distributors and processors that satisfy the selection criteria of being engaged in distribution and processing of mango. Also, the leaders of the various cooperatives were contacted both on phone and in-person so as to reach their members for this study. Panel data were obtained by interviewing these actors in November 2019 and June 2020 where they provided data on revenue generated in the previous production season before the interview.

3.5.7.2 Methods of Data Analysis

A primary data was collected with a well-structured questionnaire from 240 respondents (i.e 150 mango producers, 60 distributors, and 30 processors). Descriptive statistics and econometric

analysis models were used to analyze the data collected from various mango value chain actors such as producers, distributors, and processors. STATA and Microsoft Excel version 16 software were used to analyze the data collected.

3.6 Study Area

The study was conducted in the Greater Accra and Eastern and Volta Regions of Ghana because they are considered as the major mango-producing regions in the country. These areas are dominated by smallholder farmers who are into commercial production. In addition, these places provide adequate rainfall, soil nutrients, and sunlight for mango production in Ghana. There are two rainy seasons in these mango-producing districts of Ghana: March to July and September to November, with a peak in May-June. As a result, there are two harvest seasons: the main season, which lasts from mid-May to mid-July, and the minor season, which lasts from December to January.

Commercially mango production in Southern Ghana is mainly found in the Greater Accra, Eastern, and Volta Regions. Therefore, the Yilo Krobo and Okere municipalities (in the Eastern Region), the North Tongu district and Kpando municipalities (in the Volta region), and the Shai-Osudoku District (in the Greater Accra Region) were purposively selected for the study due to the organized nature and volume of production in these areas. Processors and distributors are scattered across these three regions mentioned above due to their proximity to the production areas. Hence, the commercial mango processors such as Blue Skies, Bomarts, HPW -fresh and dry, Eden Fruits among others together with small-scale processors and distributors were selected across the three regions.

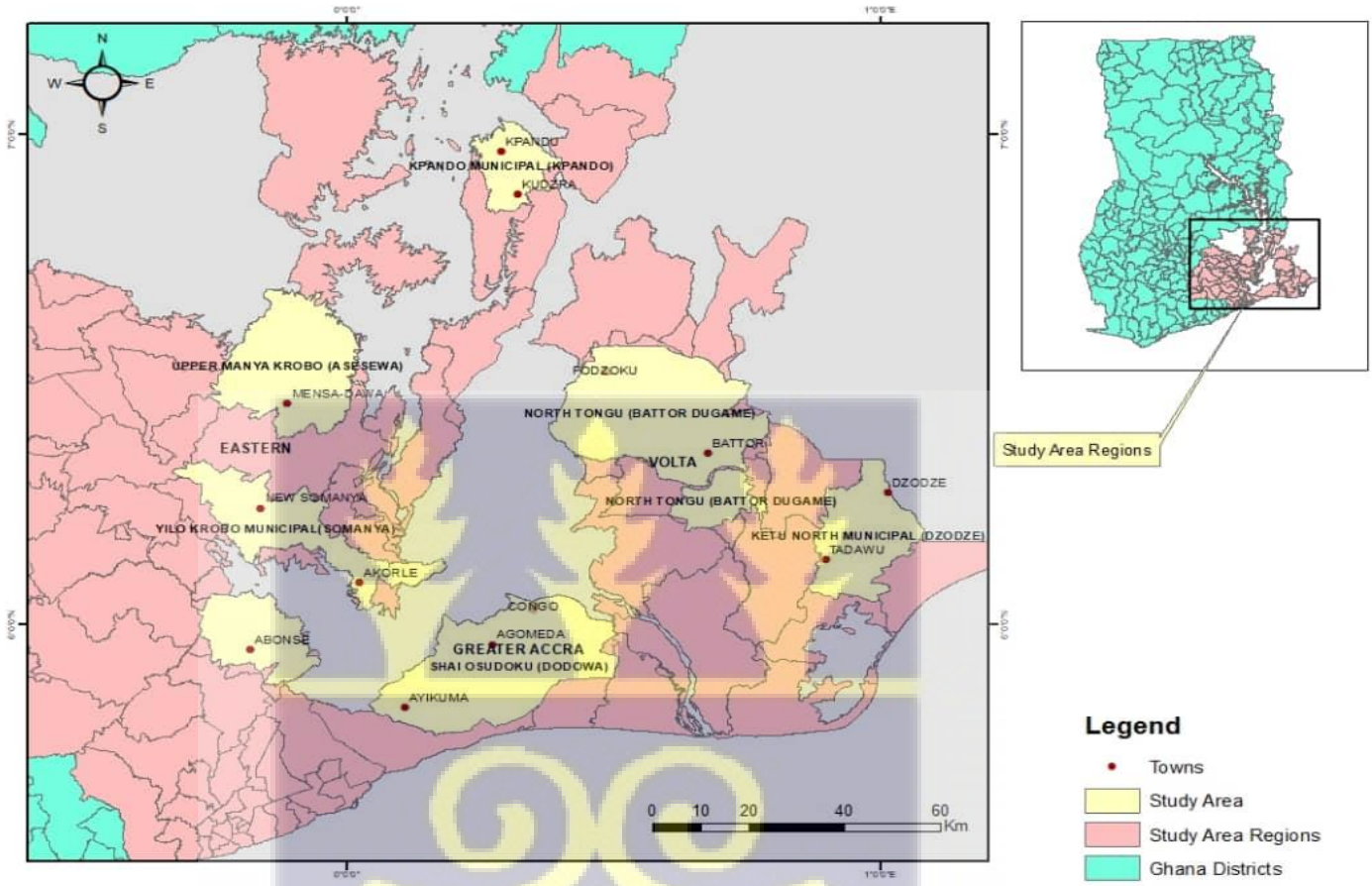
Eastern Region

The Eastern region has a land area of 19,323 km^2 and it is the sixth-largest region in Ghana. With a population of 2,106,696 people, it is the third most populated area in Ghana, following Ashanti and Greater Accra (Pettengell, 2010). Farming and other agricultural-related work are the main occupation of the economically active population in the region (Pettengell, 2010). Lower and Upper Manya Krobo Districts to the north and east, respectively, share shared boundaries with Yilo Krobo Municipality. The Shai-Osudoku and Akwapim North Districts lie to the South of the municipality. The Municipality shares a border with New Juaben and East Akim in the southwest. The municipality is also bordered on the west by the Fanteakwa District and it is located between 60.00'N and 00.30'N, and between 00.30'W and 10.00'W in longitude.

The municipality's estimated area of 805 square kilometers, accounting for 4.2 percent of the Eastern Region's total area. The Capital of the Municipal is Somanya and it is approximately 45 km from Koforidua and 50 km from Accra, the nation's capital. This gives the region a great opportunity for export and high earnings due to its proximity to the airport and urban market. With annual rainfall ranging from 750 to 1600 mm in the southeast and relative humidity varying from 60 to 93 on the slopes of the Akwapim mountains in the northwest, the eastern area has a bi-modal rainy season that peaks between May and June and September and October. The temperature ranges from 24.90°C to 29.90°C. Agriculture employs 57.3 percent of the district's households, with the majority of farmers engaged in mango production and others in distribution and processing. Most of these farmers are into the production of mango which is exported and consumed locally in their raw state (Ghana Statistical Service, 2014). The Eastern region is Ghana's sixth-largest region, with a land area of 19,323 km2. With a population of 2,106,696, it is the third most populated area in Ghana, after Ashanti and Greater Accra. The predominant

occupation of the economically active population in the region is farming and other agriculture-related employment (Pettengell, 2010).

Figure 5: The map of the Study area (Eastern, Greater Accra, and Volta Region)



Source: Geography Department, University of Ghana

Greater Accra Region

The Greater Accra lies in the south-central part of the country bordering the Central Region on the west, the Volta Region on the east, the Eastern Region on the north, and the Gulf of Guinea on the south. From the provisional result of the 2021 population and housing census data, the total population size of the Greater Accra region was about 5,446,237 which constituted 17.68 percent of Ghana's total population of 30.8 million (GSS, 2021). According to Ghana Statistical Service

(GSS) report, it is the second most populated region after the Ashanti region. With 87.4 percent of the country's population residing in cities, the Greater Accra area is the most urbanized in the country. Its capital city is Accra which serves as the capital city of Ghana. The main agricultural activities in the region are fruits and tree crops (mango, pineapple, watermelon, etc), livestock/Poultry production, fishing, maize cultivation, irrigated vegetable gardening cassava production among others.

The Shai-Osudoku District, in Ghana's south-east, is one of the agricultural-related districts with a total land area of 968.361 square kilometers. The district capital is Dodowa. In June 2012, Dangme West District was divided into two districts, Ningo Prampram District and Shai-Osudoku District, based on LI 2137. It is bordered on the north by the North Tongu District, on the west by the Yilo and Lower Manya Districts, on the west by the Akwapim North District, on the south by the Kpone Kantamanso District, on the south by the Ningo Prampram District, and on the east by the Ada West District. The absolute maximum temperature is 40°C. The average annual rainfall in the north and north-east ranges from 762.5 milliliters near the seashore to 1220 milliliters towards the Akwapim Range. Agriculture is the district's main source of revenue, employing 58.6% of the population. Fruits grown in the Shai-Osudoku District include mangoes, pineapples, and bananas (Boateng, 2016).

Volta Region

The North Tongu District, with its capital at Battor, is one of the newly formed District Assemblies in 2012. The district's climate is tropical, with the South-West Monsoons from the Atlantic and the dry Harmattan winds from the Sahara having a significant impact. The rain has a bimodal pattern. The major one runs from the middle of April to the beginning of July, while the minor one runs from September to November. The average annual rainfall ranges from 900 to 1100 mm, with

more than half of it falling during the main season. Throughout the year, the temperature and relative humidity fluctuate slightly. The average temperature is 27°C, with daily minimum and maximum temperatures ranging from 22°C to 33°C. Agriculture is the most important economic sector in the district. Agriculture employs 64.9 percent of the population. Maize, cassava, groundnuts, cowpea, sugar cane, vegetables, oil palm, rice, and mangoes are the main crops grown (Boateng, 2016).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the empirical results of the study. A description of the socio-economic characteristics of the actors (producers, distributors (wholesalers and retailers) and processors) are presented. This is followed by the mapping of the main actors, their roles, and interactions are presented. Finally, the results on the power relations, cooperation among the producers against pest infestation, marketing outlets, the impact of COVID-19 on the mango value chain, and the various constraints faced by the mango value chain actors.

4.2 Characteristics of Respondents

4.2.1 Gender

As shown in *Table 1*, out of 150 producers 100 (66.7%) were male; and 50 (33.3%) were female. However, a study on *Socio-Economic Factors Influencing Tomato Supply and Consumption* carried out by Hamza (2017) discovered that 90% of 100 sampled tomato farmers in the Tamale Metropolis were male while 10% were female. The difference in the number of males to female may be a result of the capital intensiveness of mango production in Ghana and how men are required to put food on the table or the bread winners of the family. One producer during the interview, mentioned that *I needed to enter mango farming to be able to cater for my family and to be fully responsible with respect to other family problems*. Mango distributors (wholesalers and retailers) in the value chain were made up of 3 (5.0%) males and 57 (95.0%) females while processors comprise 7 (23.3%) males and 23 (76.7%) females respectively. This is quite similar with the findings of Kumi (2017) where he found a majority of tomato distributors about 74% to be females.

Table 1: Socio-Demographics of the Respondents

Characteristics	Producers (N=150)		Distributors (N=60)		Processors (N=30)	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Gender						
Male	100	66.7	3	5	7	23.3
Female	50	33.3	57	95	23	76.7
Age						
20-30	16	10.7	1	1.7	6	20.0
31-40	33	22.0	12	20.0	17	56.7
41-50	33	22.0	24	40.0	7	23.3
51-60	30	20.0	16	26.7		
61-Above	38	25.3	7	11.7		
Marital status						
Single	15	10.0	10	16.7	8	26.7
Married	128	85.3	42	70.0	22	73.3
Divorced	5	3.3	2	3.3	-	
Separated	2	1.3	6	10.0	-	
Education						
No education	12	8.0	8	13.3	-	
Basic education/Middle/JHS	81	54.0	39	65.0	12	40
SHS/Voc/Tech	34	22.7	13	21.7	6	20
Tertiary	23	15.3	0	-	12	40

Source: Survey data, 2021

4.2.2 Age

Table 1 shows that the majority of the mango producers interviewed fell within the age range of 60 and above with 25.3% while the age of the remaining fell below the age of 60 years. This shows that mango production is dominated by aged people especially those above 60 years. This could be said that mango production serves as a retirement job for many pensioners. On the hand, Adu (2018) found rice farmers in the Northern region of Ghana to be dominated by economically active people whose average age is about 38 years.

About 40% (24) of the distributors interviewed fell within the age range of 41-50. The age of the remaining distributors was 1, 12, 16, and 7 who fell within the age range of 20-30, 31-40, 51-60, and 61 and above respectively. This finding shows that a large number of the distributors in the three regions in the southern part of Ghana fell within the 41-50 age range. This means that mango distributors are mostly middle-aged persons. This contradicts the findings of Hamza (2017) where he found that majority of tomato distributors in the Tamale Metropolis fell within the age range of 20-40. Meanwhile, out of the 30 processors interviewed 17 (56.7) persons aged between 31 and 40.

4.2.3 Marital Status

Most of the actors interviewed for this study were married. About 85.3% of the mango producers interviewed were married while 10% were still single at the time of the interview. About 3.3% and 1.3% of the producers were divorced and separated respectively. Similarly, Clottey (2014) found about 77.9% of pig producers in Kassena Nankana East of Ghana to be married. For distributors and processors, a greater percentage of about 70% and 73% were married and the rest belong to other marital status categories respectively as detailed in *Table 1*. This suggests that the actors in the mango value chain are dominated by married persons. Since mango business involves the use of more labour, being married is advantageous as the other partner can help in doing some of the production and marketing activities. This goes a long way in cutting production and some marketing cost.

4.2.4 Highest Education Obtained

Table 1 revealed that the majority of the actors interviewed for this study had at least basic or middle or JHS education. The study shows that 81, 39, and 12 of producers, distributors, and processors respectively interviewed had basic education. This implies that most of the actors

interviewed can read and write and hence any learning material to enhance productivity and efficiency of the mango value chain may be beneficial to them. This is quite similar to Ninson (2012) findings, where he identified that majority of pineapple producers in Akwapim South Municipal area have acquired basic education. Also, information accessibility and dissemination by this group of people is better and enhances their productivity than those without an education.

4.3 Governance Structure

Table 2 illustrates the perception of the various actors in the mango value chain on the governance indicators. The results revealed that processors were perceived by the other actors (producers and distributors) to have the highest influence in terms of profit (37.92%) and while distributors were perceived by processors and producers to have the highest influence with respect to bargaining power (35.65%). This finding concurs with Clottey (2014), who found out that in the pig value chain processors are perceived to have the highest influence in terms of profit as compared to distributors and producers.

Table 2: Governance in Mango Value Chains

Governance structure	*Producer (%)*	*Processors (%)*	*Distributors (%)*
Profit	29.99	37.92	32.68
Bargaining power	31.13	34.97	35.65
Information concentration	33.01	37.34	30.13

Source: Survey data, 2021

On the contrary, processors and distributors perceived those producers of mango in the southern part of Ghana had the least influence in terms of profit (29.99%) and bargaining power (31.13%).

This finding is similar to what was found by USAID (2007) where small producers were perceived to have little bargaining power compared with the other actors along the artichoke value chain.

The result revealed that mango distributors in the southern part of Ghana were perceived by other actors to exercise control or influence in terms of profit about thirty-three percent (33%), bargaining power about thirty-six percent (36%), and perceived to be information concentrated about thirty percent (30%).

Finally, the finding revealed that mango processors had the highest information concentration relative to mango producers and distributors. Distributors were perceived to have the least information concentration in the mango value chain in the southern part of Ghana.

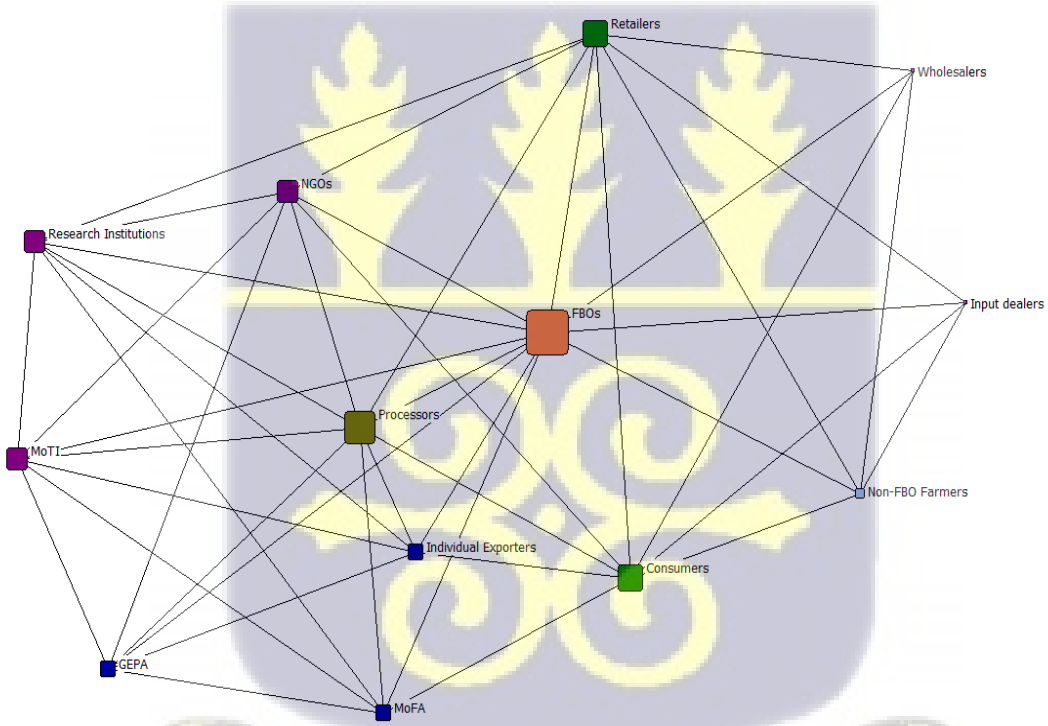
4.4 Actor Linkages in Disseminating Market Information in the Mango Value Chain

As represented in *Figure 6*, Farmer Based Organisations (FBOs), processors and research institutions form the core nodes (stakeholders) while exporters, non-FBO farmers and input dealers are the periphery nodes in market information dissemination within the mango value chain. The FBOs are the most central actor with the highest number of ties with other actors in the network than any other actor. This highlights their local popularity and how significant they are in dissemination of market information which is one of the incentives for being a member of the association (Stockbridge *et al.*, 2003).

FBOs served as the umbrella over the farmers of which support agencies such as the GEPA and exporters and actors like NGOs and processors find it easier and much better working with especially in setting prices for the mango fruit. From the field, it was observed that almost all the FBOs meet at least once a month to provide technical training to their members, share market information and productive logistics (if there is any), and educate members on how to deal with

some existing and potential challenges regarding production and marketing that the mango farmers may face (Etwire *et al*., 2013). During these meetings, important market information concerning price, quality of the fruit, demand, and supply of the mango fruit, and even the varieties in demand internationally which could improve their utility in the market are discussed. This equips the farmers with the right information which enhances their productivity and efficiency (Stockbridge *et al*., 2003). Also, many of the actors interviewed described FBOs as a strong voice for the farmers especially for policy development and price setting in the mango sector.

Figure 6: Mapping Stakeholders in the Dissemination of Market Information within the Mango Value Chain



Source: Field Data (2021)

Next to FBOs with a higher number of ties in the system are processors followed by consumers and retailers. These actors have quite a higher number of ties that followed FBOs closely. This shows the extent of their connection and role in providing and enhancing access to market

information which improves productivity, marketing, and distribution of the mango fruit and its products along the value chain. For example, the retailers have interaction with both the FBO and Non-FBO members and also consumers making them one of the actors that could disseminate information to these stakeholders to enhance their activity in the value chain. Moreover, the next group of actors with a high number of ties is MoTI, NGOs and research institutions.

On the other hand, some actors have weak ties in the system. These actors include input dealers, wholesalers, and non-FBO farmers. The weak ties of these actors depict their less interaction with other actors in dissemination of market information. Even though these actors perform other key roles in the mango industry, their activities in line with access to market information are less as revealed by this study. For instance, Offei-Aboagye (2019) mentioned that GEPA as a trade platform institution works with MOTI in enhancing the export of some cereal crops and horticultural crops such as mango among others. Even though they occasionally perform export training, national export awareness training, and some personal advisory services, the study revealed that their activities with regard to the dissemination of key market information in the mango sector are minimal. Besides, other roles and activities they perform to facilitate the export of agricultural products from Ghana correspond with the standards set by the Ghana Standard Authority (GSA) and other international regulatory bodies such as the United Nations Industrial Development Organization (UNIDO) and Centre for the Promotion of Imports from Developing countries (CBI) (Offei-Aboagye, 2019).

Wholesalers' weak interaction with other actors is quite surprising however their small population or number in the market could be a contributing factor. Their weak interaction reveals unwillingness to disseminate those market information such as the real price of the mango and demand trends prevailing in the mango market to other value chain actors. This is quite similar to

Charles *et al.* (2020) findings where traders (retailers) were found to have weak interaction with other actors in a study assessing the interaction among actors in improved rice varieties innovation system in Tanzania. In their study, actors with weak interaction have the least influence and hence perform periphery roles.

4.5 Actor Centrality Measures in the Access to Market Information

Further analysis using the centrality measures presented in *Table 3* reveals that FBOs have the highest in-degree score (91.67) while retailers had the highest out-degree score (58.33). This suggests that the most prominent actor in terms of dissemination of market information in the mango value chain are FBOs while retailers are the most influential actors. This implies that FBOs had about 92% of existing ties or interactions indicating that they receive more interaction with regards to dissemination market information within the value chain than other actors. The study highlights that between FBOs and Non-FBO farmers, there is more market information available to FBOs than non-FBO farmers. Their prominent role and position in the value chain is affirmed by highest eigenvalue score of 57.66. FBOs perform a vibrant role in ensuring group cohesion, engagement, and linkages among actors with regards to non-FBO activities, as noted also by Uckert *et al*. (2017) and Onumah *et al*. (2021).

Also, Veit (2009) documented that the members of FBO receive more information which enables them to better control pests and diseases, appropriately use fertilizers and pesticides, and access finance and market. Literature pointed out that FBOs take advantage of better market opportunities, have better bargaining power, and benefit economies of scale which could be linked to consistent search and access to market information than other actors like non-FBO farmers (MoFA, 2018).

Table 3: SNA Centrality Measures of the Value Chain Actors

Actor	In-Degree	Out-degree	Betweenness	Coreness	Eigenvalue
FBOs	91.67	66.67	37.21	42.1	57.66
Retailers	33.33	58.33	7.12	36.8	42.30
Research Institutions	41.67	50.00	6.99	31.6	44.68
NGOs	58.33	50.00	11.27	31.6	46.15
Processors	50.00	50.00	3.99	31.6	50.53
Non-FBO Farmers	58.33	41.67	20.45	26.3	39.53
GEPA	33.33	50.00	4.03	31.6	38.44
MOFA	25.00	41.67	2.00	26.3	34.04
Consumers	33.33	33.33	2.32	21.1	24.13
Wholesalers	33.33	25.00	0.82	15.8	24.13
Exporters	25.33	33.33	2.75	21.1	32.46
MoTI	50.00	25.00	2.58	15.8	39.81
Input dealers	8.33	16.67	0.49	10.5	14.33
Network Centralization Index = 24.10%					

Source: Survey data, 2021

Dissemination and accessibility to market information underlines their connectedness with other members within the value chain. Next to FBOs with a higher in-degree score are Non-FBOs and NGOs. Observation from the field revealed that the contribution of these two actors with respect to dissemination of information is helping to improve quality of mango fruit, quantity produced among others. For instance, some of the research work conducted by NGOs like GIZ, AGRA among others helps to identify missing indicators and the various factors that can be used to help facilitate efficient mango value chain in Ghana. Also, they engage the farmers at the local level by sharing with them their findings and what they can do to increase productivity, efficiency, and

distribution. This explains how they also receive interaction within the mango value chain in disseminating market information.

On the other hand, retailers are the most influential actors since most of the interactions are initiated by them more than what they received from other actors. The relatively high influence of retailers within the value chain points out that they are one of the major sources of market information that relates to product quality, price, marketing outlets, variety in demand, and packaging among others which could improve the market efficiency of other actors and maximize their utility. The initiation of interaction in dissemination of market information underlines their connectedness with most of the actors within the mango value chain.

The highest betweenness score of 37.21 by FBOs implies that they are the bridging actor within the mango value chain highly assisting access to market information. The plausible explanation is that they serve as a collective voice for a group of farmers and are connected to most of the actors within the value chain. The next set of actors that serves as bridges as revealed and presented in *Table 3* are non-FBO farmers, NGOs, and retailers. For example, non-FBO farmers having a higher betweenness score imply that they play a role in helping access and disseminate mango market information to other actors within the value chain. Also, NGOs with a betweenness score of 11.27 imply that they also serve as an intermediary and have the potential to effectively disseminate market information which could be possible through its publication of reports, papers and contacts with other value chain actors. The study found the network density to be 0.51 indicating 51% of direct ties are present and connected in the network. According to Chindime *et al.* (2016), a network density of 45% highlights a low or minimal level of possible direct connection of actors within the network. By this reasoning, the study's network density of 51% expresses moderately strong interaction existing between the actors resulting in an increasing

volume and speed of the flow of market information within the mango value chain (Gnyawali & Madhavan, 2001).

4.6 Multinomial result for Mango Producers (Farmers)

The Multinomial Logit (MNL) model for this study is statistically significant at a 1% level of significance. The hypothesis that predictor variables have no effect is thus, rejected at a 1% level of significance. The MNL model's coefficients are quite not straightforward to articulate and are better understood utilizing the concept of marginal effects (Hatirli *et al*., 2004; Goktolga *et al*., 2006). The marginal probability or effect estimates the change in the chance of each explanatory or independent variable changing the probability of the mango value chain actors (producers, distributors, and processors) choice of a specific outlet. Marginal probabilities with their coefficients are presented in *Tables 4*, *5*, and *6*.

Producers

The multinomial regression model for producers presented in *Table 4* was estimated for three dependent variables which include local market, export market, and processor market. For model specification, mango farmers that sell directly to local markets are defined as the reference group as detailed in chapter 3. Six variables such as quantity produced in 2019, quantity produced in 2020, reliable customers, FBO membership, size of farmland in hectares, and gender were significant in this study. Explanatory variables such as age, marital status, high cost of inputs, and higher output price are possible variables to influence mango farmers' outlet choice decisions but were found not to be significant in this study. Hence, discussion will be based on significant variables.

Table 4: Multinomial Regression Result for Mango Producers

Base outcome: Local market				
	Export market		**Processor's market**	
Variable	**Marginal effect**	**P>|t|**	**Marginal effect**	**P>|t|**
Constant		.078		0.044
Gender	0.012	0.807	-0.241**	0.016
Age	-0.000	0.962	0.004	0.212
Marital Status	-0.008	0.891	0.044	0.694
High Cost of input	0.071	0.501	0.156	0.316
Higher price	-0.046	0.343	0.893	0.893
Quantity prod-2019	0.002*	0.051	0.020**	0.020
Quantity prod-2020	-0.001	0.158	-0.045**	0.045
Reliable customers	-0.147***	0.004	-0.195	0.195
FBO membership	0.013	0.778	0.259***	0.004
Farm size	0.009**	0.017	0.029***	0.003

Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively.

Source: Survey data, 2021

The marginal effect of the multinomial logistic model indicates that the size of the mango farm is positively related to the exporters market and processors' market at 5% and 1% respectively relative to the base category. For instance, a unit increase by one (1) hectare of land by a mango farmer would increase the probability of selling to exporters and processors by 0.9% and 2.9% respectively. This is quite similar to findings from Adu (2018), who emphasize that when a farmer increases his/her rice farm by a hectare, there will be an increase in the probability of selling his/her rice output to processors by 7.1%. The study observed that an average mango farmer holds a farm size of about 6.4 hectares. According to Dung (2020), a unit increase of farm size (1,000 m2 per household) causes an increase in the probability of becoming cooperative members by 2.3% higher than those households whose farmland size is small. The study observed that farmers with large

farm sizes join cooperative groups and hence sell their farm produce to processors and exporters as compared to the local market.

Moreover, Farmer Based Organization (FBOs**)** is statistically significant to our model and it positively influences farmers' choice of processor market at 1% as compared to the local market. Tadesse & Kassie (2017) argued that membership of a cooperative or FBO increases the commitment, participation, and performance of farmers in a market organization. Since FBOs have the advantage of bulking and gaining economies of scale over non-FBO farmers, their members tend to sell outlets that maximize their utility. Also, many large-scale traders like processors or processing firms tend to enforce the grade and quality requirements of the niche markets through reaching farmers in FBOs rather than non-FBO farmers due to its easier and cheaper operation with the FBOs. Hence, membership of association increases the probability of the farmer choosing processor market by 26% relative to the local market. In a study by Muthini (2015), where selling to brokers at the farm-gate was the base category, he asserted that membership of a cooperative (FBO) increases farmers' likelihood of selling to the export market by 17%. These outcomes reinforced the relevance of collective action as detailed in literature by some institutional economics writers; Markelova & Mwangi, (2010), de Janvry *et al*. (1991), and Salifu *et al*. (2010), among others.

In addition, a reliable customers variable was hypothesized to positively influence a farmer's decision to sell in a particular market. However, the reliable customers variable was found negative and significantly influence the farmer's decision to sell to local markets rather than selling to exporters. This means that the probability of a farmer selling to export market outlets reduces by 14%. This is because these buyers or customers tend to buy the mango produce at a cheaper price due to the customer relation and perception that the farmers would not get anyone to sell to them.

This influences the quantity of mango produced to be given to the export market. Also, the negative correlation implies that farmers with reliable customers give more of their produce to the local market. According to Hailu (2016) and Panda & Sreekumar (2012), a good customer relationship increases farmers' commitment and assurance of the customers to whom they are going to sell their produce to which eventually lessen their opportunistic behaviour.

Moreover, the quantity produced in 2019 was high and hence, significantly influence the decision of the mango farmers to participate in both export and processors market at 10% and 5% respectively. This high volume of production in 2019 could be attributed to easy access to farm inputs, increased farm size, low level of attack by insects, pests and diseases, favourable weather among others. Ermias (2021) specified in his study that farmers that produce in large quantities tend to sell their produce to market outlets that buy in large volumes and offer a good price. This could be one reason for those who produced in large quantities in 2019 and 2020 to participate in the export and processor market instead of the local market. A study conducted on market facilities and agricultural marketing in India by Shilpi & Umali-Deininger (2008), explained that in a situation whereby there is poor market infrastructure like most of the local or rural markets, farmers with high volume production incur a high transaction cost selling to these local markets, thus are compelled to sell to other outlets like export market relative to local markets to get more positive returns or profit. Also, the perishability and seasonality nature of mangoes cause farmers to sell to buyers like exporters who have the capacity to buy in large volumes at the farm-gate relative to the local markets who buy in small quantities.

From *Table 4*, the quantity of mango produced in 2020 reduced the likelihood of farmers selling to the processor market as compared to the local market. The negative relation with the quantity produced in 2020 could be as a result of a low volume of production, limited access or delay in

response by processor market, and other factors such as fruit infestation by insects as a result of limited access to pesticides for management among others. Hence, farmers were more likely to sell to the local market than to sell to processors.

COVID-19 shocks and its measures such as the lockdown and closure of the sea and air borders was mentioned by many of the mango farmers and have been confirmed by the result as a reason influencing the farmer's decision to sell to the local market to be able to recover some capital invested and avoid fruit rotting and dropping as a result of long waiting for the processing firms. This suggests that farmers will switch their choice of marketing outlet when faced with exogenous factors beyond their control like the COVID-19 pandemic. This is similar to findings from Honja *et al*. (2017) who reveal that quantity of mango produced positively informs the choice of local market (wholesaler market) outlet over other marketing outlets and this is significant at less than 1% implying that when a quantity of mango produced increases probability of selling to the local market (wholesalers) directly increases relative to other markets. This occurs because the local market outlet (wholesalers) purchases the mango at once without selection like the processing firms and exporters. This finding has a close similarity with Geremewe *et al*. (2019) who found out that potato quantity sold had a positive correlation with choosing a local market (wholesaler, consumer, and retailer) outlet at a 5% significance level and negatively influenced the likelihood of choosing processor outlet at 5% significance level. Finally, the gender of farmers was found negative and statistically significant at 5 percentage points. This means that male farmers are 5 percentage points less likely to sell to the processor market as compared to the local market during the COVID-19 pandemic. The plausible explanation is that in a situation where processors are not apt to procure the fruits from the farmers on time as against fruit rotting on the farm and post-harvest losses, male farmers tend to sell to other alternatives like the local market. This is to avoid

loss of the capital invested and also gain some revenue for the next production season as narrated by most of the farmers. Similarly, Honja *et al*. (2017) found more than 70% of mango farmers in Ethiopia to be selling their mango fruits to a local market (wholesalers, retailers, collectors).

Distributors

The multinomial logit (MNL) regression model for distributors represented in *Table 5* was estimated for three dependent variables which include small-scale processor market, other retailers, and direct consumer market. For model specification, mango distributors that sell directly to other retailers are defined as the base outcome group as detailed in chapter 3. The P-value for the Wald test statistics (Prob>chi2) was 0.000 and the Pseudo r-squared was 0.147 which implies that the multinomial regression model specification is significant and best fits the data. About seven (7) independent or explanatory variables were used to assess distributors' choice of market outlet. The MNL outcome revealed that reliable customers, number of buyers, ownership of transport, higher price, and marital status are the various variables that influence the choice of a particular outlet of the distributors. Age, educational level, access to market information, value addition, and price are some variables that were not significant in the model. The discussion is based on explanatory variables that were found significant.

The Ownership of transport was expected to positively influence the market outlet choice of mango distributors. The result indicates that a unit increase of a vehicle owned by a mango distributor increases the probability of choosing to sell to small-scale processors as compared to other retailers. Geoffrey *et al*. (2014) noted that vehicle ownership drives a farmer's marketing outlet decision since it lowers the transport cost as well as boosts the volume of transport. Also, their study reveals that vehicle ownership increases the proportion of sales of the farmer compared to those without a vehicle.

Table 5: Multinomial Regression Result for Mango Distributors

Base outcome: Other retailers				
	Small-scale processors		Direct consumers	
Variable	**Marginal effect**	**P>|t|**	**Marginal effect**	**P>|t|**
Constant		0.000		0.000
Age	-0.003	0.555	-0.002	0.665
Educational level	0.101	0.163	-0.060	0.204
Marital status	0.161*	0.030	0.023	0.686
Access to market information	0.015	0.880	0.035	0.625
Reliable Customers	1.738***	0.001	1.154**	0.013
Higher output price	0.628*	0.068	0.367	0.284
Number of buyers	-0.555***	0.001	-0.384**	0.017
Ownership transport	0.895***	0.000	-0.099**	0.015
Value addition	-0.039	0.724	-0.033	0.730
Price	-0.001	0.918	0.001	0.912
Number of obs.	60			
Pseudo r-squared	0.147			
Prob > chi2	0.000			
Log likelihood =	-47.499435			

Source: Field Survey, 2021 (*** *p<.1%*, ** *p<.5%*, * *p<.10%* significant levels, respectively).

This finding coincides with the study by Jagwe (2011) who found out that bicycle ownership increases the sales of bananas in Burundi, Rwanda, and the Democratic Republic of Congo. In a like manner, mango distributors who own transport facilities tend to procure or buy more of the mango fruits from the producers which invariably increases their likelihood of selling to small-scale processors than other retailers.

Also, if a transport facility owned by a distributor increases by one unit, the probability of selling directly to consumers reduces by 9.9% as compared to other retailers. This suggests that when a

distributor's transport ownership increases by a unit, there is more likelihood of selecting other retailer markets than direct consumers. This is emphasized by Chalwe (2011) who stated that transport or vehicle ownership increases the probability of conveying goods to private traders in the market.

Moreover, customers reliability influences the volume or quantity of a material to be sold and determines the choice of market outlet. This variable was significant and positively influences the decision of mango distributors to sell to small-scale processors and direct consumers at 1% and 5% respectively. The result shows that when small-scale processors and direct customers become reliable to mango distributors, it increases the quantity of mango given to them by 174% and 115% respectively. This implies that the greater proportion of mango procured by mango distributors is given to small-scale mango processors and direct consumers than other retailers. Dash *et al.* (2014) conducted an empirical study on "*Conjoint-based Preferential Segmentation of Fruits and Vegetable Choice of Indian Consumers*" and found that consumers prefer to buy their fruits from supermarkets as a result of reliability. This affirms the significance of reliability of a product in informing their purchasing decision or reliability of a customer to buy the product available.

Also, the marginal effect of higher output price reveals that it was significant in the model and positively influences the distributors' market outlet choice implying that when a unit output price of mango becomes high, distributors will tend to sell their mango fruits to small-scale processors relative to selling to other retailers. This evidence is supported by the theory of utility where a household is assumed to maximize utility by choosing how much of his/her product or produce to sell relative to a set of constraints such as cash constraint, resources availability, and production function (Otekunrin *et al*., 2019).

Moreover, as at the time of our visit to the study areas, an average price of 1Kg of mango was GH₵1.80 thus, the marginal effect of 0.628 suggested that a unit increase in the output price of mango fruit per 1kg is more likely to increase distributors' probability of selling to small-scale processors than other retailers (Adu, 2018).

Furthermore, the number of buyers as stated in *Table 5* was expected to positively influence distributors' decisions however, it negatively influences their decision. The negative relationship implies that when the number of buyers of mango fruit from distributors increases the likelihood of a distributor choosing small-scale processors and direct consumers reduces by 55% and 38% respectively. This could be as a result of the better price offered by other retailer outlets since they tend to bid up the price of the mango in the market. Hence, distributors will channel their produce to other retailers to be able to earn positive sales or profit.

Finally, the marital status variable was categorized with value one (1) for those who are married and zero (0) for those who are otherwise. The result was found to be significant in the model and is positively related to the marketing outlet decision of distributors. The marginal effect of 0.161 suggests that an increase in the number of distributors who are married increases the likelihood of selling to small-scale processors by 16% rather than selling to other retailers. Aturamu *et al*. (2021) found marital status as one of the key factors that influence the marketing outlet of gari processors in Ondo state, Nigeria.

Processor

The multinomial logit (MNL) regression model for processors represented in *Table 6* was estimated for three dependent variables which include direct consumers, export market, and supermarket. The study defined direct consumers as the base outcome group in the MNL processors model. The P-value for the Wald test statistics (Prob>chi2) was 0.000 and the Pseudo r-squared was 0.544 which implies that the multinomial regression model specification is significant and best fits the data. About seven (7) independent or explanatory variables were used to assess processors' choice of market outlet. The MNL outcome revealed that higher output price and gender are the variables that significantly influence the selection of market outlets by mango processors as presented in *Table 6.* A number of variables were found not to be significant which include; age, volume bought, Labour cost, number of buyers, and reliable customers. The discussion of the result is based on significant variables.

Primarily, the study revealed that the higher output price offered by the foreign market influences the probability of selling the processed mango product to the export market. Since the cost involved in the processing and transporting the processed mango product is very high and the primary objective of most businesses is to maximize profit, the mango processors explained that most of their products are given to outlets that will enable them to recoup the cost involved in the production of the mango fruit. This is reinforced by the result of the marginal effect, where a higher price was statistically significant at 1% and indicates that when the price of the processed mango becomes higher, the likelihood of a mango processor selling to the export market increases by 98.3% relative to the direct market. Berg (2017) explained that HPW fruit and dry, which is one of the commercial fruit processing firms in Ghana set the price of their products in line with what is given by Fair Trade International. But this study found that the higher output price set by Fair

Trade for the processed mango fruit is better than what is received domestically from the direct consumers thus, the decision of mango processors to export their product rather than selling to direct customers.

Table 6: Multinomial Regression Result for Mango Processors

Base outcome: Direct consumers				
	Export market		**Supermarkets**	
Variable	**Marginal effect**	**P>|t|**	**Marginal effect**	**P>|t|**
Constant		.004		0.000
Gender	0.654***	0.000	0.001	0.546
Age	0.005	0.250	-0.000	0.591
Higher output price	0.983***	0.000	-0.992***	0.000
Volume bought	0.052	0.454	-0.000	0.935
Labour cost	-0.012	0.558	-0.000	0.561
Number of buyers	-0.098	0.219	0.093	0.251
Reliable customers	-0.049	0.399	0.050	0.316
Number of obs	30			
Pseudo r-squared	0.544			
Prob > chi2	0.000			
Log likelihood =	-14.389			

Source: Field Survey, 2021 (**** p<.1%, ** p<.5%, * p<.10%* significant levels, respectively).

The negative relation of higher output price under the supermarket category suggests that when the price of the processed mango becomes higher, mango processors will prefer selling directly to the consumer market rather than selling to supermarkets. The result infers that the likelihood of mango processors selecting direct consumers over supermarkets increases by 99.2% when the output price of the processed mango product becomes higher.

Also, gender is statistically significant and positively influenced mango processors' participation in the export market as compared to direct customers. This implies that being a male mango

processor increases the probability of participating in the mango export market by 65.4% with all other factors remaining constant. This finding could be a result of the domestic responsibility of men (male), which could cause them to prefer selling their produce to export markets to earn more or to maximise their utility to provide for the family and perform other financial related responsibilities for the household as similarly documented by Doss (2001). Geoffrey *et al.* (2014) found gender to be one of the significant variables that influence the choice of marketing outlet by pineapple producers in Kenya. Their study reveals that male pineapple producers have a higher probability of selling their produce at the local market by 27.81%.

4.7 The Impact of COVID-19 on Profit of Mango Value Chain Actors

4.7.1 Profit earned by the mango actors between 2019 and 2020

The profit earned by the value chain actors in 2019 and 2020 production seasons are presented in *Table 7*. The study revealed that mango producers and distributors profit reduced while mango processors profit increased between 2019 and 2020 which could be linked to the outbreak of the COVID-19 disease. On average in 2019, a producer (farmer) earned a profit of about GH¢8189.1 per hectare while the same farmer receives GH¢7062.3 per hectare as his or her profit in 2020. These outcomes for the two production seasons revealed that mango producers (farmers) experienced a downturn in profit by 11.9%. This could be as a result of the outbreak of the COVID-19 virus and its related implications or shocks which imperatively disrupted marketing outlets previously employed by the mango farmers coupled with some exogenous factors like unfavourable climatic conditions for the fruits, post-harvest losses, incidence of pest and diseases among others that could affect production and marketing related activities (FAO, 2021). The majority of the farmers testified how they lost their customers or outlets due to fear of coming into contact with the virus. This underlines farmers' decision of selling their produce to any available

outlet in order to avoid fruit dropping and post-harvest losses even in the face of unreasonable prices given.

Table 7: Profit earned by the mango actors between 2019 and 2020

	Producers (GH¢)		***Distributors (GH¢)***		***Processors (GH¢)***	
	2019	**2020**	**2019**	**2020**	**2019**	**2020**
Maximum	47042	42139	18260	15249	355473.3	427473.3
Average	8189.1	7062.3	1807.93	1285.41	34728.53	67955.6
Minimum	-6865.7	-7413.2	-2295	-2212	-1250	750
T-test						
T-cal	1.967		1.980		2.002	
T-crit	1.795		-1.584		-1.307	
Decision rule: H_o = Rejected, since T-cal>T-crit						

Source: Survey data, 2021

Similarly, the study revealed that the mango distributors experienced a decrease in profit during the outbreak of the COVID-19 pandemic. On average a mango distributor earned a profit of GH¢1285.41 per tonne in 2020 as compared to GH¢1807.93 per tonne made the previous year. This highlights a 40.6% reduction in the profit earned by mango distributors. This negative change in profit could be attributed to the ebbing of the COVID-19 disease that resulted in closure of restaurants, bars and schools which are primary component of local consumers that buys from distributors (FAO, 2021). This disrupted the marketing and distribution of mango to these outlets from the distributors. Also, as a result of the COVID-19 shock on the finances of most people, a lot of consumers were forward-buying with the available income in anticipation of shortage and

supply of food or agricultural products (Richards & Richard, 2020). In view of this, most consumers spending was rationed towards agricultural product such as maize, millet, rice, yam among others to sustain their entire household amidst the COVID-19 pandemic as compared to buying of most perishable products like mango, pineapple among others. Even though, there was a directive on consumption of fruits and vegtables, most consumers as mentioned by distributors were sensitive on their spending in the southern Ghana. Also, labour and transport logistics were some challenges that affected distribution of food including mango. With transport logistics, there was a limited number of trucks for transportation of the fruits for mango distributors from the production points to the market due to the fast spread of the COVID-19 disease. This compelled most distributors to use unappropriate transport facility which resulted in the poor quality of the fruit and higher transportation cost (Gray, 2020).

Moreover, the study observed that mango processors received a positive profit during the outbreak of the COVID-19 pandemic. On an average a mango processor earned a profit of GH¢67,955.6 per metric tonnes in 2020 as compared to GH¢34,728.53 made in the previous year. This highlights a 95.7% increment in the profit earned by mango processors. This positive change could be resulted from the cheap price at which they procured the produce from the farmers and also, due to the directive by the Governemnt of Ghana for consumption of fruits (mango) and vegetables to boost the immune system against the COVID-19 virus(FAO, 2021).

Also, this suggests that consumers preference for mango shifted towards the processed mango during the outbreak of the COVID-19 virus. This is consistent with a statement made by an executive member of Blue Skies Company Limited who stressed that production volume per week increased significantly as compared to the previous year due to the COVID-19 pandemic which significantly increased the profit earned by their company in Ghana. However, one challenge

mentioned by most of the mango processors that export their product was high transportation cost which resulted from the closure of the borders and restrictions at the airport.

Additionally, on an average the minimum profits earned by mango producers for 2019 and 2020 production seasons were GH¢-6865.7 and GH¢-7413.2 respectively. This means that a minimum profit made in 2020 compared to 2019 by mango producers increased by 7.97% ~8%. Mango distributors and processors also made a minimum profit of GH¢-2295 and GH¢-2212, and GH¢-1250 and GH¢ 750 respectively. These changes in profit made by the mango value chain actors could be linked to to factors imposed by the COVID-19 pandemic measures coupled with existing marketing and production constraints which are ranked in *Activity 4.8*.

The t-test statistic calculated is higher than the t-test critical examined for all the actors and these are statistically significant at 1%. This suggests that there is a significant difference in the profit earned by the mango value chain actors between 2019 and 2020, hence the null hypothesis is accepted. This significant difference highlights the fact that the various factors identified in *Activity 3.4.4* significantly impacted the various actor's profit and hence, the difference.

4.7.2 The Impact of COVID-19 on the Profit of Mango Mango Value Chain Actors

Table 8 presents the impact of COVID-19 on the profit earned by the mango producers, distributors and processors. For producers, the result of the impact assessment using the Difference in Difference model revealed that farmers earned a positive profit during pre-COVID-19. However, due to the stringent lockdown measures and some other restrictions which include the closure of the borders, restrictions on movement of both human and goods and social gatherings among others imposed during the outbreak of the COVID-19 virus, the mango farmers' profit was negatively impacted as shown in *Table 8*. The outcome of the study reveals that the profit earned by the farmer per hectare in 2020 decreased by a factors of 0.79 ~ 80 as a result of the COVID-19

pandemic and is statistically significant at 1 percent. The closure of the borders in a bit of containing the COVID-19 virus and some other restrictions imposed within the country and by neighbouring countries and product destination markets limited access to some marketing outlets such as exporters and processors and farm inputs like pesticides and herbicides, increased transaction cost of the farmers and fluctuating output price. These are some factors that could be attributed to the decline in profit earned by the farmers (Schotte *et al*., 2021). Several producers especially those with large farm size and produced large volumes of mango explained that they received reduced quantity of mango purchased by these marketing outlets compared to the quantity that was previously obtained.

Similarly, Bassier *et al*. (2020) hinted that the COVID-19 pandemic negatively impacted the informal workers in South Africa and their households due to their vulnerability to the economic consequences posed by the pandemic. TechnoServe, an agribusiness firm which seeks to provide solutions to poverty reports that due to the impact of the COVID-19, most farmers may tend to be less resilient to future threats like the COVID-19 pandemic. This is because the farmers were hit by the pandemic unexpectedly and most of them had to make serious and most difficult decisions regarding ther production and marketing.

The estimate of the difference in difference (Diff-in-Diff) for distributors as tabulated in *Table 8* shows that those in the treated group before the COVID-19 pandemic was making a positive profit of about GH¢ 1755.3 averagely compared to those in the control group who were making GH¢ 930.3. However, during the outbreak of the COVID-19 virus in Ghana there was a declined in the profit earned by the treated group (GH¢ 1306.97) of the distributors compared to the control group (GH¢ 3360.82). The Diff-in-Diff outcome revealed that profit of the distributors declined by GH¢

3200 as a result of the outbreak of the COVID-19 virus and this is statistically significant at 10 percent.

Table 8: DID Estimate Results for Mango Mango Value Chain Actors

	Producers				Distributors				Processors			
Outcome variable	Profit	S. Error	|t|	P> | t|	Profit	S. Error	|t|	P> | t|	Profit	S. Error	|t|	P> | t|
Before												
Control	3.67				930.33				9.939			
Treated	3.69				1755.31				8.570			
Diff (T-C)	0.02	0.21	0.10	0.92	824.98	915.23	0.90	0.37	-1.368	0.518	-2.64	0.011**
After												
Control	4.32				3660.82				9.246			
Treated	3.55				1306.97				9.870			
Diff (T-C)	-0.77	0.12	6.53	0.00***	-2.4e+02	1655.74	1.42	0.16	0.444	0.397	1.12	0.270
Diff-in-Diff	-0.79	0.24	3.34	0.00***	-3.2e+02	1891.86	1.68	0.09*	1.812	0.653	2.78	0.008***
R-square:	0.28				0.07				0.05			
Inference:	*** p<0.01; ** p<0.05; * p<0.1											

The covariate variables such as information access, value addition, and consumer response were identified to have influence on the profit earned profit earned by the mango distributors during the COVID-19 pandemic. These covariate variables are presented in the *Table 9* and the discussion of the variables are based on the variables that are significant in the model.

The outcome of the Diff-in-Diff analysis for mango processors presented in *Table 8* was found to be significant at 1 percent. The p-value of Diff (T-C) shows that there was a significant impact of COVID-19 such that the profit of the processors increased significantly by a factor of 1.8. That is during the COVID-19 pandemic, mango processors experienced an increment in their profit compared to the previous year and this was significant at 1 percent. Directives by the Government of Ghana, FAO and other health-related institutions on fruit and vegetable consumption to boost the immunity could be a contributing factor for a positive rise in the profit of processors in 2020 (Abroquah, 2020).

4.7.3 The Covariate for Producers, Distributors and Processors

The covariates presented in *Table 9* reveal the extent of how these factors impacted the processors profit. The study reveals that consumer response to the outbreak of the COVID-19, prices of input and distance to market. The consumer response is explained on page 112 while the other factors are discussed below is based on their significance.

Table 9 presents the covariate variable employed in the difference-in-differences (DID) model to assess the impact of COVID-19 on profit generated during the outbreak of the COVID-19, (the year 2020) as compared to what is earned before COVID-19 (the year 2019). The data was matched to reduce biases in the result (Fredriksson & Oliveira, 2019). Out of the six (6) independent variables that were tested, three (3) were statistically significant to the model, namely; gender, prices of inputs, and consumer response to COVID-19 restrictions employed.

Table 9: Covariates that Impacted Mango Value Chain Actors Profit

Producers				Distributors				Processors			
Variable	Coefficient	Standard error	P-Values	Variable	Coefficient	Std. error	P-Values	Variable	Coefficient	Standard error	P-Value
Information access	-1.436	0.962	0.135	*Information access*	-1.31**	0.735	0.074	*Information access*	0.923	0.611	0.131
Herbicide app.	1.097	1.066	0.304	*Value addition*	2.13***	0.778	0.006	*Higher price*	-0.929	1.099	0.398
Consumer response	-1.392**	0.664	0.035	*Consumer response*	1.076**	0.537	0.045	*Consumer response*	4.739**	2.593	0.068
Amt. of labour	-0.052	0.089	0.564	*Amt. of labour*	0.008	0.005	0.147	*Amt. of Labour*	-0.312	0.902	0.730
Price of inputs	-2.197**	1.002	0.028	*Price of input*	-.709	.0716	0.322	*Price of input*	-0.848**	0.499	0.089
Farm size	-0.006	0.102	0.952	*Marital status*	-0.031	0.560	0.957	*Dist. To market*	1.244**	0.630	0.048
Gender	-0.240***	0.916	0.009	*_cons*	-1.364	1.137	0.231	*Packaging*	0.103	1.062	0.922
Age	-0.035	0.030	0.247					*Transport asset ownership*	-4.879	1.112	0.329
_cons	1.504	1.630	0.356					*_cons*	-4.879	3.685	0.186
No. of obs. =	157			55				30			
r-squared	0.266			0.264				0.256			
Prob > chi2 =	0.019			0.003				0.206			
Log. L.	-25.273			-27.719				-15.881			

Gender: the study observed that gender of the farmers in relation to the profit earned during the COVID-19 pandemic was negative and statistically significantly at 1 percent. This suggest that the profit earned by the male farmers declined by a factor of 24 as a result of the COVID-19 pandemic compared to what was earned the previous year. Since male farmers are believed to have own large farms as compared to female farmers and may be the major producers selling to exporters and processors, this downturn in profit earned could be as a result of COVID-19 restrictions that

disrupted marketing of goods especially those farmers selling to exporters and processors(Selim *et al.*, 2022). Also, this decline in profit could be aligned with the increase in prices of inputs which made it impossible for many male farmers to buy enough agrochemicals to manage their farms hence, resulting in post-harvest losses and limited access to market outlets looking for better quality mango fruits (Abroquah, 2020).

***Price of inputs*:** The result reveals that price of inputs for producers and processors were both statistically significant at 5 percent and negatively impacted their profit. The coefficient of the variable suggest that prices of inputs potentially reduced the profit of the producers and processors by a factor of 2.2 and 0.85 respectively. This suggests that due to COVID-19 pandemic, farmers were unable to but enough farm inputs such as fertilizers, pesticides, fungicides among others to apply on their farms as a result of a hike in the price of farm inputs posed by COVID-19 compared to the previous year. The hike in price could be attributed to limited access to production inputs brought up by restrictions on movement of goods through both airport and in-land borders. This concurs with findings from (Salazar *et al.*, 2020; FAO, 2021) who explained that many farmers had difficulty not only accessing foodstuffs in markets but also faced a challenge in accessing farm inputs during the outbreak of the COVID-19. This was worsened when government security personnel were restricting the movements of traders of farm inputs and food despite their exempt status (Ragasa *et al.*, 2020). Another factor mentioned by a majority of the farmers was the fact that their finances were hit hard by the outbreak of the COVID-19 especially those who engage in business activities at social events like funerals, weddings, and church services to generate some revenue to manage their farms. Selim *et al.* (2022) and Abroquah (2020) penned that available income or capital to be invested on the farm through pesticide application and other farm management activities were diverted to secure enough food for the household. These factors made

it impossible for farmers to purchase the available inputs for their farm activities and negatively impacted their profit. Similarly, processors also lamented about the rise in prices of packaging materials and other inputs used for processing mango due to restrictions on import and export (FAO, 2021).

Consumer Response: Consumers response to government directives such as increase in consumption of fruits to boost immunity significantly affected the mango value chain actors such that distributors and processors were impacted positively while producers were impacted negatively. The finding reveals that the profits of producers declined by a factor of 1.39 whilst that of distributors and processors increased by a value of 1.08 and 4.74 respectively. Distributors mentioned during the interview that due to the fast spread of the COVID-19 disease the local government regulated the number of distributors in the market each week which limited their access to information and market. This also limited the quantity purchased and limited number of mango distributors at the major market centers which negatively affected their profit.

Value addition: Profit maximization and increased in nutritional security of consumers is one of the major benefits of value addition (Sharma *et al*., 2010). Value addition was statistically significant at 1 percent and positive impacted on the profit of the distributors. This suggest that the distributors who added value to their mango fruit had the likelihood of increasing their profit by 213 percent as compared to those who did not add value to their fruits. As a result of the COVID-19 pandemic, there a directive for more consumption of fruits and vegetables by the Government of Ghana. In response to this directive there was a high demand for all fruits including mango which led some distributors to add value to their fruit by cutting it into sizeable containers and some were cleaned and packaged into sizeable paper boxes. These value-added fruits were sold online and at the roadside along some major highways in the country. Sharma & Mehrotra (2007)

mentioned that value-added products channeled through mix channels to reach consumers increase sales and the profit of the sellers.

Information Access: Access to quality information provides better opportunity to sell to good marketing outlet, reduces transaction cost and helps avoid being cheated by buyers or provides stronger bargaining power. The result revealed that due to the COVID-19 pandemic, access to information and profit of mango distributors were inversely related. This means that inability to access quality information affected the distributors negatively thus, revealing a likelihood of reducing profit by a factor of 1.3. Also, it highlights how activities in the market were disrupted and suspended due to the fast spread of the COVID-19 virus and its devastating impact on health and social life. This resulted in negative profit earned by distributors. In addition, the inverse relationship between profit earned by distributors and information access revealed the weak interaction among the distributors and other value chain actors during the COVID-19 pandemic. This suggest that the access to information was limited by the imposition of the restrictions and those who had the information were also unwilling to share so they could take advantage of the situation to maximize their profit.

Distance to market: this variable was statistically significant at 5% and indicates a positive relationship with profit earned by processors. The plausible explanation could be the rise in demand which led to more distribution to highway retail vendors and other domestic available market (Buckmaster, 2012). A distribution or sales manager of Eden Fruits said that *due to the outbreak of the COVID-19 more people placed a demand for mango fruit juice as compared to the previous year*. This increases the cost of transportation for mango processors and have the likelihood of severely influencing the mano processors profit.

4.8 Constraints of Actors along the Mango Value Chain

In this section constraints that faced actors along the mango value chain are assessed and discussed. A number of constraints have been identified to be affecting the mango producers, distributors, and processors. But the discussion is based on the three most pressing constraints facing each of the actors. Generally, the incidence of pest and diseases, fruit rotting or post-harvest handling, and poor quality of the mango fruit is the most pressing constraints facing producers, distributors, and processors respectively. *Tables 10, 11,* and *12* present the ranking of the various constraints faced by producers, distributors, and processors respectively.

4.8.1 Constraints of Mango producers

Kendall's W for ranked constraints was 0.55, indicating that the rankers of the constraints are in agreement by 55 percent. This suggests that farmers had a high level of agreement in rating the limits to their production activities, which was significant at 1%. The chi-square derived from the statistical table with a 5% (0.05) significance level and 8 degrees of freedom was 1.86, but the chi-square calculated from the simulation was 660.28. As a result, the null hypothesis was rejected since the chi-square estimated using Kendall's coefficient of concordance is bigger than the chi-square calculated from the statistical table. This implies, there is a significant agreement among the rankers of the constraints. The result was supported by the probability value of 0.000 which is less than a 1% significance level.

The study revealed that mango producers (farmers) in the study area are confronted with many constraints. The most common and pressing constraints to most of the farmers were the incidence of pests and diseases, the high cost of farm inputs outbreak, and unreliable markets. These constraints were ranked in the order of 1 up to 3 with a mean score of 1.73, 2.85, and 2.96

respectively, and is represented in *Table 10*. Unavailability of labour was ranked as the least pressing constraint with a mean score of 7.11.

Table 10: Constraints Faced by Mango Producers

Constraints for Producers	Mean	Rank
Incidence of pest and disease	1.73	1
High cost of farm inputs	2.85	2
Unreliable market	2.96	3
Low Price	4.93	4
Unavailable storage/packhouse facilities	5.28	5
Inadequate funds for production	6.58	6
Lack of access to current market information	6.85	7
Low yield	6.73	8
Unavailability of labour	7.11	9
Diagnostic Statistics		
Number of observations	150	
Kendall's W[a]	.550	
Chi-Square (cal)	660.275	
Chi-Square (Crit)		
Degree of freedom (df)	8	
Asymp. Sig.	0.000	

Source: Survey, 2021

Incidence of pests and diseases: most of the farmers lament over the omen called the mango Bacterial Black Spot (BBS) disease. This bacteria disease was first found in Australia in the early 1980s and has now spread across the world and is adversely affecting mango farmers in Ghana. It was first recorded in Ghana in 2011 and was noted to be the first report about BBS to be announced in West Africa. Currently, it is believed to have been spread to other West African countries and across the world especially mango growing areas. This disease can adversely affect the fruits by causing even 100% yield loss due to massive dropping of the unripe or immature fruits and could have fruits that reach maturity have a rotten dark spot on them. According to Honger (2019), all fruits can get rotten in a severe infestation. For example, a report from Prakash & Misra (1992),

penned that the devastating effect of this disease leading to yield loss could range from 50% to 100%. This is not different from what the majority of the mango producer (farmers) are going through in Ghana which is very affected here as their major pressing constraint. "BBS disease is our main headache. *This disease is affecting our mango production, marketing, income and livelihood and development of the mango sector*"- this is a response from a farmer when asked about the major constraint he is facing as a mango farmer.

High cost of farm inputs: most farmers mentioned that during the outbreak of the COVID-19, prices of farm inputs such as insecticides, fungicides, fertilizers, and spraying machines turn out to be limited in access and very expensive (Abroquah, 2020). The unexpected hike in the price of inputs made it unbearable for purchase by most of the farmers of which some were compelled to reduce the quantity they usually buy as a result of limited capital. Also, literature revealed that the outbreak of the COVID-19 had a shock on the finances and livelihood of both urban and rural people including mango farmers. As a result of this shock, some farmers lamented about their inability to afford to buy the farm inputs especially fertilizers, pesticides, and other recommended agrochemicals required for the production year. To ascertain the hike in input prices mentioned by farmers, some agrochemical dealers were contacted who also said that the prices of inputs increased by a high margin as a result of the closure of the borders which was one of the measures adopted by the state in dealing with the spread of the novel Coronavirus. This has come with high costs of productive inputs which most farmers were unable to afford and it has affected the quality of fruit, quantity, and eventually, income received at the end of the production season (Annor *et al*., 2014).

Unreliable markets: Results indicated that an unreliable market is one of the hurdles that is weakening the production and marketing activities of farmers (Madulu & Chalamila, 2007). The

mean score obtained is 1.14. The farmers complained that because of the unreliable reliable market for their produce during the outbreak of the COVID-19, their mango fruits were not purchased on time which resulted in huge fruit rotting or dropping since the fruits were left on the farm waiting for ready market willing to give a relatively good price. This sometimes compels them to accept any price given for the fruit (FAO, 2021). On the other hand, most of the buyer's or farmers explorable marketing outlets took advantage of the situation to offer a relatively low price to farmers with the reason that government through the local assemblies have limited the number of traders and number of times they sell at the market centres within a week. As a result of this, they experience post-harvest loss of the fruits they buy from the farmers.

4.8.2 Constraints of Mango Distributors.

For the distributors, the Kendall's ranked had 72% agreement among the rankers of the constraints. This implies that there was a strong agreement among distributors in ranking the constraints facing their distribution and marketing activities and this was significant at 1 percentage point. The chi-square calculated was 388.87 and the chi-square obtained from the statistical table with 5% (0.05) significance level and 9 degrees of freedom was 1.83. The null hypothesis was rejected since the chi-square estimated using Kendall's coefficient of concordance is bigger than the chi-square critical calculated from the statistical table. This indicates that the constraint rankers have a high level of agreement and are backed up by a probability value of 0.000 which is statistically significant at 1 percentage point.

Among the ten (10) constraints identified in literature and presented to the mango distribution respondents, fruit rotting or post-harvest loss, poor quality of mango fruit and high transportation cost were the three (3) most pressing constraints ranked with mean scores of 1.83, 1.91 and 3.48 respectively. Thus, the discussion is based on these three most pressing constraints.

Table 11: Constraints Faced by Mango Distributors

Constraints	Mean	Rank
Fruit rotting or post-harvest losses	1.83	1
Poor quality of mango fruit	1.91	2
Higher transportation cost	3.48	3
High cost of mango fruit	4.34	4
Access to credit	5.23	5
Reduced demand for mango fruit	6.92	6
High cost of labour	6.97	7
Unreliable source of mango fruit	6.99	8
Lack of market	7.98	9
Poor road network	9.35	10
Test Statistics		
Number of observations (N)	60	
Kendall's W[a]	0.720	
Chi-Square	388.87	
Degree of freedom (df)	9	
Asymp. Sig	0.000	

Source: Survey, 2021

Fruit rotting or Post-harvest losses: this was the most pressing constraint ranked by the mango distributors. Due to the perishability nature of mango, many of the fruits get rotten when there is no ready market. Also, this resulted from bad post-harvest handling and the agrochemicals used by the farmers. Also, there were reports made by distributors that some producers apply some agrochemicals during the COVID-19 while the fruits were on the mango tree to induce the tree to start flowering right after harvesting. It is believed that due to the high cost of agrochemicals due to the COVID-19 pandemic (Abroquah, 2020), farmers applied cheap and probably unprescribed agrochemicals on their farms and this resulted in fruit rotting a few days or weeks after harvesting. Additionally, the closure of some restaurants and pubs in certain business centres in the country in response to the COVID-19 preventive measures limited the supply of fresh mango fruit which also

resulted in the fruits getting rotten with the distributors. These were among the reasons provided by distributors as a contributing factor of fruit rotten. This concurs with Ngereza & Pawelzik (2016) who found post-harvest loss as one of the major constraints that affect organic fruit production in Tanzania.

***Poor quality of mango fruit*:** poor quality of the fruit was ranked as the second most pressing constraint that hurdles the distribution and marketing activities of mango distributors. Many distributors narrated and this is similarly documented by Abroquah (2020) that farm inputs were limited in access and its prices became quite high due to COVID-19. As a result, the poor quality of the mango fruit could be attributed to the mismanagement of pests and diseases and other husbandry practices on the farms by the farmers. This mismanagement of the farm rendered most of the mango trees to produce poor quality fruits which is vulnerable to spoilage and thereby making distributors incur a loss (Kiaya, 2014). Also, some distributors explained that when farmers experience unfavourable weather conditions like too much rain during the flowering stage of the mango tree, it affects the quality of the fruit.

***High transportation cost*:** since production of the mango fruit occurs in rural and remote areas far from consumption or market centres, most of the distributors travel from far distant places to purchase the mango fruit. By implication, distributors have to transport the fruits from the farm to the market centres and this makes them incur a lot of cost especially for those who do not own a transport facility. The poor nature of the roads connecting to the market centres, poor transport infrastructure coupled with an uncertain hike in fuel prices due to the COVID-19 pandemic increases the transportation cost of most distributors transporting the mango fruits from the production areas to the market centres. This correlates with Phillip *et al*. (2009) study where they identified high transportation cost as one of the main issues affecting the supply of fertilizer from

port to inland destinations. From their study, they asserted that high transportation cost is clear evidence of the poor state of rural roads in Nigeria. A summary report presented by Ghana Statistic Service (GSS), United Nations Development Programme (UNDP), and German Agency for International Cooperation (GIZ) in 2021, narrated that the transportation of inputs and output of agribusinesses have been negatively impacted by the COVID-19 pandemic. It is emphasized in the report that the disruption of transport by the outbreak of the COVID-19 virus resulted in no transport and or unregular transport system with a high cost of input and output transportation which undesirably affected the fresh food (mango fruit) supply chain in Ghana (FAO, 2021).

4.8.3 Constraints faced by mango Processors

The result of Kendall's W ranked by processors was 0.515 which means that there was 52% agreement among the rankers of the constraints indicating a strong agreement among processors in ranking the constraints facing their processing and marketing activities and this was significant at 1 percent. The chi-square calculated was 92.70 and the chi-square obtained from the statistical table with 5% (0.05) significance level and 6 degrees of freedom was 2.45. It can be therefore concluded that since the chi-square calculated from Kendall's coefficient of concordance is greater than the chi-square critical obtained from the statistical table, the null hypothesis was not accepted. This implies, there is a significant agreement among the rankers of the constraints. The result is presented in *Table 12* and is supported by the probability value of 0.000 which is significant at 1%. Poor quality of mango fruit was ranked the major pressing constraint facing the mango processors in southern Ghana. This constraint was ranked as 1 with a mean score of 1.73 by the mango processors out of the list of 7 constraints presented. This was followed by high input cost due to COVID-19 and unreliable supply ranked as 2 and 3 with a mean score of 2.33 and 3.57 respectively.

Poor quality of mango fruit: This was the most pressing constraint ranked by the mango processors. *Even though we ensure good quality of the fruit before buying, we believe some of the farmers do not manage their farms well. Also, some post-harvest handling and the poor nature of our roads attribute to fruits getting rotten and rejected at the factory.* This is a response from one of the key informants from a private processing company.

Table 12: Constraints Faced by Mango Processors

Constraints	Mean	Rank
Poor quality of Mango fruit (raw material)	1.73	1
High inputs cost	2.33	2
Unreliable or insufficient supply of raw material	3.57	3
Poor road network	4.07	4
Competition from other processors	5.20	5
High cost of labour	5.37	6
Limited access to marketing information	5.73	7
Test Statistics		
Number of observations (N)	30	
Kendall's W[a]	.515	
Chi-Square	92.700	
Degree of freedom (df)	6	
Asymp. Sig	0.000	

Source: Survey, 2021

Factors such as unfavourable weather conditions, poor husbandry practices, and untimely application of agrochemicals such as fertilizers, pesticides, fungicides, and insecticides posed by COVID-19 in accessing agrochemicals which contributed to poor management of most of the farms largely attributed to the poor quality of the mango fruits produced during the outbreak of COVID-19. Nuamah (2014) stresses that raw material of poor quality is one of the major factors militating against the establishment and operation of agro-processing firms like Blue Skies Product Limited in Ghana. When fruits procured for processing are rejected based on poor quality, it

reduces the quantity of what is produced and limits the volume of what is taken to the market which by implication reduces the revenue that would have been generated from the market should the whole quantity of raw material procured is processed.

High input cost: this was ranked as the second most pressing constraint facing the mango processors in southern Ghana. Inputs for all actors along the value chain became high due to COVID-19 control measures like the closure of the borders and restrictions on the number of goods imported and exported by affected countries which imperatively affected import and export of both agro-processing inputs and output and its prices (Nchanji *et al.*, 2021). This concurs with the Agribusiness Tracker report by GSS, GIZ and UNDP presented in 2021 which revealed that the supply of inputs to agribusiness firms in Ghana between March 2020 and May 2020 decreased by 52.4%. similarly. Lakuma *et al.* (2021) observed a 66.4% and 62.6% decline in input supply from local firms and foreign firms (imported) respectively in Uganda. Their study opined that limited access to imported inputs increases the cost of available input which exacerbated the operations of most agro-processing firms.

Unreliable supply: many processing firms need raw materials to feed their production units to meet demands. When supply becomes unreliable and inconsistent, the activities of the processing firm become distorted (Bordi *et al*., 2021; Salazar *et al*., 2020). Unreliable supply or inconsistency in the supply of mango fruits by the farmers to processing firms is noted by most of the mango processing firms contacted. The processors narrated that some of the farmers are not consistent in the supply of good quality fruits which sometimes affects them adversely especially when the supplier is a large contributor to the volume of mangoes purchased in each production season. This constrains their fast production and marketing activities and sometimes compels them to source their fruit from neighbouring countries. This situation was worsened by the outbreak of the

COVID-19 virus where mango fruit suppliers (farmers) together with processors were hit by the pandemic as a result of the measures enacted to contain the spread of the virus. This situation among other equally important reasons resulted in an unreliable supply of mango fruit being ranked as the third most pressing constraint among the eight (8) constraints presented during the COVID-19 era.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter summarizes the impact of COVID-19 on the profit of value chain actors in southern Ghana. It highlights the analytical models and the data used, the findings in *activity 5.2* as well as the conclusion and recommendation of the study in *activity 5.3* and *5.4* respectively. Conclusion and policy recommendations are based on the findings of this study.

5.2 Summary and Major Findings

This study sought to analyze the COVID-19 and its impact on the profit of the mango value chain actors in Southern Ghana specifically, to identify actors within the value chain that facilitate dissemination of market information and the linkages between them, identify and analyse the factors that influence the choice of marketing outlet used by the value chain actors, assess the impact of COVID-19 on the profit of the value chain actors as well as the constraints militating against the value chain actors in southern Ghana. The study used data from 240 respondents covering 150 mango producers, 60 distributors, and 30 processors. The data used is panel data which for 2019 and 2020 production season. The study employed social network analysis, multinomial logit model, difference-in-difference model, and Kendal's Coefficient of Concordance to analysed the specific objectives of the study. The UCINET software, Microsoft excel version 19, and STATA software were used to analyse the data collected.

The findings revealed that mango production in Ghana is dominated by male farmers as compared to female farmers. Meanwhile, the distributors and processors actor category in the mango value chain is dominated by females. The study identified that many producers of mango are 40 years and above. The age range of the majority of the distributors and processors was found to be

between 41-50 and 31-40 respectively and about 55 and 80 percent of all the actors (producers, distributors, and processors) had at least basic education and are married respectively. With the governance structure, the study found that mango processors make the highest profit as perceived by producers and distributors while producers make the least profit as perceived by processors and distributors. The mango distributors were perceived as those with the highest bargaining power while information is found to be concentrated with mango processors.

The core actors identified by the study in the dissemination of market information were Non-FBO Farmers, NGOs, FBOs, Retailers, and Research Institutions. Retailers were found to be the most influential actors while FBOs were the most prominent actors with regards to dissemination of market information. FBOs were revealed by the network as the bridging stakeholders(node) connecting other stakeholders in the dissemination of market information system.

In addition, the thesis revealed that farm size, FBO membership, quantity produced both in 2019 and 2020, gender, reliable customers, and marital status are the key factors that influence the marketing outlet of producers. Also, number of buyers, higher output prices, ownership of transport, reliable customers, and marital status were the various factors that determine the choice of marketing outlet by mango distributors in the study area. The study found that the mango processors' marketing outlet decision is influenced heavily by higher output price and gender.

Moreover, the COVID-19 pandemic had a heterogeneous impact on the agriculture, profit, and livelihood of both urban and rural people. The study revealed that mango farmers and distributors had a negative profit as a result of COVID-19 response measures which limited access to some marketing outlets like processors and exporters. These marketing outlets are identified to be the outlets that buy the farmer's produce in large quantities and mostly offer better prices. Similarly,

the negative profit received by distributors were as a result of some factors like information access, value addition and consumers response to COVID-19 restrictions

On the other hand, processorss were found to be making a positive profit due to the rise in demand for fruits and vegetables to boost immunity against the COVID-19 disease.

Finally, the incidence of pests and disease, high cost of inputs and unreliable market were identified to be the most pressing constraints limiting the production and marketing activities of mango producers. Post-harvest losses (fruit rotting), poor quality of the fruits and high transportation were the major pressing constraints mentioned by distributors to be affecting their mango marketing activity. Mango processors in southern Ghana on the other hand ranked poor quality of the fruits, high input cost and unreliable supply of raw material (mango fruit) as the most pressing constraints militating their production, marketing and distribution.

5.3 Conclusions

The study concludes that actors like FBOs and retailers perform explicit roles in disseminating market information and some of these roles are enhanced and heterogeneously supported by policy development and regulatory actors along the mango value chain in southern Ghana. Retailers were found to be the most influential actors while FBOs were the prominent actors in the network. It is hereby concluded that FBOs are the most receivers of market information as compared to any other actor in the network while retailers are identified as the major source of market information. The dissemination of market information facilitated by FBOs and retailers boost productivity and ensure efficiency and effectiveness of the value chain for upgrade and development. The study found stakeholders like input dealers, wholesalers, and MoTI to have the weakest ties with other stakeholders in the dissemination of market information in southern Ghana. In a nutshell, these stakeholders' performance with respect to dissemination of information is minimal.

Regarding the marketing outlet decision of the actors, the study concluded that farm size, FBO membership, quantity produced, gender, reliable customers, and marital status are the major outlet determining factors that inform the decision of mango farmers. While farmers' decision is influenced by the above-mentioned factors, the mango distributors' decision is heavily linked to number of buyers, higher output price, ownership of transport, reliable customers, and marital status. Gender and higher output price are found to be the major factors influencing mango processors' marketing outlet decisions.

Moreover, the study concluded that the outbreak of the COVID-19 pandemic had a negative impact on the profit of mango farmers and distributors especially during the outbreak of the COVID-19 disease. The study identified that mango processors experience a positive impact of the COVID-19 on their profit and this was significant at 1 percent.

Finally, the mango farmers ranked incidence of pests and disease, high cost of inputs and unreliable market as the major constraints affecting their production and marketing activities. Post-harvest losses (fruit rotting), poor quality of the fruits and high transportation were the major pressing constraints mentioned by distributors to be affecting their mango marketing activity. Also, the study observed that poor quality of the fruits, high input cost and unreliable supply of raw material (mango fruit) are the most pressing constraints working against their production, marketing and distribution. These constraints ranked by the mango distributors and processors can be linked to the incidence of pests and diseases that occurred in the farms of most mango farmers. Even though post-harvest handling and other agricultural practices could attribute to the post-harvest losses and quality of the fruit, the study concluded that incidence of pests and diseases predominantly affected the quality of the fruit sometimes from the fruit setting stage of the fruit on the tree. These constraint factors observed by the study are affecting the growth and development of the mango

sector of the horticultural industry in Ghana and needs urgent attention and solution. High input cost is noted from the study to be the recurring constraint facing the actors along the mango value chain as a result of the COVID-19 pandemic.

5.4 Recommendations

The study recommends that FBOs, retailers and other key stakeholders should be encouraged in policy development with respect to market information dissemination which could allow all actors to be prepared to adapt and make positive profit especially during an exogenous situation like the COVID-19. Improvement in the dissemination of market information effectively facilitated by mango value chain actors to the farmers will also assist the farmers to use the right agronomic practices and agrochemicals to fight the incidence of pests and diseases like Bacteria Black Spot disease on their farms so as to deliver high-quality mango fruits to the market.

MoFA at the district levels together with non-governmental organisations should empower existing FBOs with the necessary and current market information which will enhance their access to better market, productivity, and utility. Extension officers of the MoFA at the district offices and policy implementing agencies like the Ministry of Trade and Industry (MoTI) and Ghana Export Promotion Authority (GEPA) should encourage mango farmers and other value chain actors to join existing cooperatives since they receive a lot of the interactions in the market information access network. This will help the mango farmers to deliver better- and high-quality mango fruit and its products to the market and negotiate price with buyers with greater strength. Also, the study recommends that in an exogeneous situation like the COVID-19 pandemic, policies that allow trade of farm inputs and produce like mango should be allowed to facilitate their distribution to desired markets. This will allow value chain actors to receive good value for their activities and to be able to but inputs at affordable prices.

Moreover, mango producers should be encouraged by MoFA to increase their farm sizes and join farmer cooperatives to be able to sell to marketing outlets that procure in large volumes and offer higher prices thus, maximizing their profit or utility. Mango distributors who do not have transport facilities should own transport facilities and initiate good customer relations with buyers of their produce to have more reliable customers to sell their mangoes to especially during COVID-19 like situations. For mango processors, the Ministry of Gender, Children and Social Protection together with non-governmental organizations like the Alliance for African Women Initiative (AFAWI) should encourage more women to join the mango processors to be able to participate more in the export market to improve upon their utility in the mango marketing business along the value chain.

To avoid earning a negative profit after high investment in production, the study recommends that the government through the Tree Crop Development Authority and MoFA should invest in agricultural warehouses that will serve as bulk absorbers for the nation thus, absorbing the produce of the farmers at a good price especially during a pandemic situation like COVID-19. This would prevent farmers who will be forced to sell their produce at any price to buyers to avoid fruit rotting and dropping during any exogenous-like situation like the COVID-19 pandemic.

Additionally, The Government of Ghana through MOFA in collaboration with MOTI should support mango value chain actors, partner with European Union (EU) and other major fruit (mango) destination markets to develop policies that will enable trade irrespective of global shocks like the COVID-19 pandemic.

Also, mango distributors should adequately check the quality of the fruits before purchase and form cooperatives that will help in transport facility procurement to ensure good quality delivery of the fruits to avoid fruit spoilage which could affect their profit during a situation like the COVID-19 pandemic. Processors of fruits like mango should increase their production capacity to

take advantage of the high demand for processed fruit products during an exogenous condition like the COVID-19 pandemic to maximise their utility.

Finally, mango farmers should use the right agrochemicals and most importantly at the right time in controlling the pest and diseases on their farms to produce good quality fruits that will not be vulnerable to post-harvest losses. Also, the study recommends that in a situation like the COVID-19 pandemic the measures put in place by most countries including both developed and under-developed countries should allow the free flow of agricultural inputs across all borders. This will prevent high cost of the inputs due to border restrictions and allow for continuous production, marketing and distribution of agricultural products to their respective destinations and consumers.

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APPENDIX

UNIVERSITY OF GHANA

DEPARTMENT OF AGRICULTURAL ECONOMICS AND AGRIBUSINESS

This study titled ***COVID-19 AND THE MANGO VALUE CHAIN IN THE SOUTHERN PART OF GHANA*** and is been carried out by BRIGHT KETADZO, a graduate student at the University of Ghana, Legon in partial fulfillment of the requirements for the award of Master of Philosophy degree in Agribusiness. He is soliciting information for this study and need your consent. Your survey responses will solely be for academic purposes and will be highly confidential. Your support and contributions will be very much appreciated.

General information

Region name:	…….....	Name of respondent:	……..
Community/village name	……	Date of interview:	|.....|...…|…….|
Household ID:	|….|….|….|		

SOCIO – ECONOMIC CHARACTERISTICS OF FARMER

A. Household demographics and composition

Q No.	Question	Options
A.01	Gender of respondent?	1=Male 2=Female
A.02	Age of respondent?	|……| years
A.03	Marital status	1= Single [ ], 2= Married [ ], 3= Divorced [ ], 4= Separated [ ]
A.04	Educational background of household head	0=No Education [ ] 1=Basic Education/Middle/JHS [ ] 2=SHS/Tech/Voc [ ] 3=Tertiary [ ] 4=Other (Specify) [ ]

B. **PRODUCTION INFORMATION**

Record of sales			
Q. No	**Question**	**Response**	
B.01	Which of the mangoes do you produce?	01= Local mangoes, 02= Exotic mangoes	
	If exotic, which varieties do you produce?	Respond by ticking 01= Kent [ ] 02= Keitt [ ] 03=Palmer [ ] 04= Other (Specify)	
B.02	How many times did you harvest mango in these years?	**2019**	**2020**
		Once=0 [ ], Twice=1 [ ], Thrice=2 [ ]	Once=0 [ ], Twice=1 [ ], Thrice=2 [ ]
B.03	How many tonnes of mango did you get after harvesting		

MARKETING OUTLET INFO:

B.04	Which of the following marketing channels do you normally sell your mangoes to?				
	a) Local market [ ] b) Supermarkets [ ] c) Contract buyers [ ] d) Foreign market [ ] e) Processing factors [ ] f) Other (Specify) [ ]				
S/N	Market outlets	Quantity		Price	
		2019	2020	2019	2020
i.	Local market				
ii.	Supermarkets				
iii.	Contract buyers				
iv.	Foreign markets				
v.	Processing factories				
vi.	Any other (Specify) ……				
B.05	Which of these mostly buy your produce				
	Which of these informs your choice of specific marketing channel?	a) Higher price [ ] b) Reduced Cost [ ] c) Reliable customer [ ] d) Distance to market [ ]			

		e) Number of buyers [ ] f) Quantity/volume bought [ ] g) Other (Specify) [ ]
B.06	What is your source of market information?	1= Radio [ ] 2= TV [ ] 3= Internet [ ] 4= Newspaper [ ] 5= Colleague farmers [ ] 6= Monthly meeting/workshop [ ], 7= Other [ ] Specify……..
B.07	Do you export your produce to any foreign country?	1= Yes [ ], 2= No [ ]
B.08	If yes, which country did you export your fruits to?	
B.09	Is there any factor that prevents you from exporting to any foreign country?	1= Yes [ ], 2= No [ ]
	If yes, which of these factors prevented you	1. High cost in adhering to sanitary and phytosanitary measures 2. Fruit quality

INPUTS

Input cost:

B.12 indicate the cost, quantity, year of purchase and lifespan of farm inputs you use for your mango production?

Implements/ equipment	**Quantity**	**Years of purchase**	**Cost of purchase**	**Lifespan of input**
Plough				
Hoe				
Harrow				
Motor pump				
Hoe				
Cutlass				
Wheelbarrow				
Pickaxe				
Others (Specify)				

B.13 What is your total farm land size? ……(Ha)

B.14 How did you acquire your farm land? 1. Rented/leased [ ] 2. Purchased [ ] 3. Inherited [ ] 4. Family/Communal [ ] 5. Other (Specify)…….

B.15a What was the rental cost of land? GH₵……

B.16 What was the cost of land if purchased? GH₵……

B.17 Indicate the quantity and the cost involved in performing these activities on your farm land.

Inputs	QTY		No. times used in		Average unit cost (GHS)
			2019	2020	
Weedicide/Herbicide application					
Pesticide application					
Fertilizer application					
Irrigation					
Weeding					
Pruning					
Tractor service					
Harvesting					
Other (Specify)					

Question	2019 (GH₵)	2020 (GH₵)
B.18a What is the cost of fertilizer used for the following production year?		
B.18b What is the cost of herbicides if used for following production year?		

B.18c What is the cost of pesticide if used for the following production year?		
B.19 What is the cost of labour in the following years		
B.20 What is the cost of weeding in the following years		
B.21 Do you have to pay tolls when transporting your fruits from farm to market	1. Yes 2. No	
If yes, how much did you pay in the following year		

Revenue:

Question	**Production year**	
	2019	**2020**
B.20a What was the total quantity of mango harvested in the following production years?	....(Kilograms)	....(Kilograms)
B.20b What quantity of mango did you sell? …….	....(Kilograms)	....(Kilograms)
B.20c How much did you receive after sale of mango in the 2019 & 2020 season? ……	....(GH₵)	....(GH₵)
B.20d What was your unit price in the year 2019 & 2020?	GH₵…….	GH₵…….

C. Relationship Among Actors

C.01 What is the relationship between you (producers) and other value chain actors (distributors, & processors) look like? 1=Cordial [ ] 2= Purely business 3= Other (Specify)……

C.02a Is there any formal (legally binding) contract between you the producer and the other value chain actors (distributors, & processors)? 1= Yes [ ] 2. No [ ]

C.02b If yes, what type of contract? 01= Verbal contract 02= Written contract 03= Other (Specify)……

C.03 Indicate the nature of the contract by responding Yes/No to the following questions

Packages in the contract	**Yes/No**
Provision of input(s)	
Provision of credit	
Provide transport	
Provide technical support	
Other (Specify)	

C.04 Is there cooperation between you and neighboring farms in dealing with pest infestation and other farm activities?

1. Yes
2. No

C.05 Which of these reasons are the cause of lack of cooperation?

a) Credit unworthiness
b) Lack of knowledge about the effect of pest infestation
c) Lack of concern for neibouring farms
d) Pest infestation not a great concern
e) Inadequate infrastructure
f) Lack of controlling body

D. IMPACT OF COVID

D.01 The outbreak of COVID'19 pandemic impacted negatively on farm activities of many mango farmers?

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.02 The outbreak of COVID'19 pandemic impacted positively on your sales of mango.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.03 The Pandemic made farmers lose buyers of the mango fruit.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.05 The outbreak of the COVID-19 pandemic affected your distribution channels.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.06 The outbreak of the COVID-19 pandemic affected access to productive resources like farm inputs, credit, among others.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.07a Did you receive any support from government or NGO during the COVID-19 outbreak in quest to ease the impact of the outbreak on your production?

1. Yes
2. No

D.07b If Yes, what support did you receive? (Please specify) ……..

D.08 Mitigation strategies like travel restrictions, ban on social gathering and export affected trade activities including mango business.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.9 (a) Did you sell more of your produce during the outbreak of Covid'19 pandemic?

1. Yes 2. No

(b) If yes, to what percentage of increment did you receive with respect to the previous year sales? ……%

D.10 Did you receive any subsidy of the input purchased during the COVID-19 pandemic?

1= Yes, 2= No

D.11 Mango producers experienced post-harvest losses during the outbreak of COVID-19 because there were insufficient buyers?

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.12 Some mango producers reduced price to minimize their fruit wastage/spoilage.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.13 Customer/buyers bargained for low prices during the outbreak of COVID-19.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

D.14 How was your demand of mango during the outbreak Covid-19 pandemic?

1= Low [ ], 2= High [ ], 3= fluctuating [ ]

D.15 Did you experience higher transportation cost due to transport restrictions during the COVID-19 pandemic?

1= Yes, 2= No

E. Governance Structure

E.01 Who determines the quantities of mango to produce?

i. Buyer ii. Seller iii. Other (Specify)……

E.02 Who determines the price of the mango fruit. 1. Buyer [ ] 2. Seller (you) [ ] 3. FBO [ ] 4. Other (Specify) [ ]

E.03 How is the price of mango determined? 1. Cost of production [ ] 2. Profit margin [ ] 3. What the market offers [ ] 4. Delay in payment [ ] 5. Other [ ]

E.04 What is your level of satisfaction for the prices you receive for the mango? 1. High [ ] 2. Medium [ ] 3. Low [ ]

E.05 What is the level of your "importance and influence "in the mango value chain in regards to the following indicators.

	Producers	Distributors	Processors
Profit			
Bargaining power			
Information concentration			

F. Market Information Access and Dissemination

1. Do you have access to market information? (a) Yes [ ] (b) No [ ]
2. Mentioned at least five actors from whom you can access market information.
3. Where to you get the market information from (a) Colleague farmers (b) FBOs (c) AEA of MoFA (d) Wholesalers (e) Retailers (f) Exporters (g) GEPA (h) GSA
4. Mention the stakeholders you disseminate market information to.
5. Do you receive training from any agricultural support institutions mentioned earlier? If Yes, name the kind of training programme you receive.
6. During this training programmes, are market information about price, demand and supply trends and quality discussed?
7. Do the market information acquired helpful in your production and marketing? (a) Yes (b) No

G. THE CONSTRAINTS FACED BY THE VALUE CHAIN ACTORS (PRODUCERS)

How would you rate the following constraints you are facing in your mango business? On a scale of 1 –12 where 1 is the most pressing constraint and 12 is the least pressing constraint.		
Code	Please answer by choosing between 1 – 12 based on the strength of the proposed challenge	Rank
G1	Unreliable market	
G2	Unavailable storage/pack house facilities	
G3	Inability to transport produce due to COVID-19	
G4	Low price due to COVID-19	
G5	Incidence of pest and disease	
G6	High cost of crop protection	
G7	Low yield	
G8	Unavailability of labour due to COVID-19	
G9	Limited access to farm inputs due to COVID-19	
G10	Inadequate funds for production due to COVID-19 shocks	
G11	Lack of extensional and advisory service	
G12	Lack of access to current market information	

QUESTIONAIRE FOR MANGO DISTRIBUTORS (WHOLESALERS & RETAILERS)

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Region name:	……..	Name of respondent:	……..
District:	…….....	Telephone number of respondents:	
Community/village name:	…… ….	…….	
Date of interview:	|.....|..…|…….|	Name of Enumerator:	……..

SECTION A. SOCIO – ECONOMIC CHARACTERISTICS OF THE DISTRIBUTOR

Q No.	Question	Options
A.05	Gender of respondent?	1=Male [ ] 2=Female [ ]
A.06	Educational background of respondent?	0=No Education [ ] 1=Basic Education/Middle/JHS [ ] 2=SHS/Tech/Voc [ ] 3=Tertiary [ ] 4=Other (Specify) [ ]
A.07	Marital status	0= Single [ ], 1= Married [ ], 2= Divorced [ ]

SECTION B: MARKETING ACTIVITIES & VALUE ADDITION

B.01 Which of the mango did you sell in the following years?

01= Local [ ] 02= Exotic [ ] 3= Both

2019	2020

B. 02 If exotic, which of the varieties do you sell? 01= Kent [ ] 02= Keitt [ ] 03= Palmer [ ] 04= Other (Specify) [ ]

B.03 Which varieties do buyers/consumers mostly prefer?

01= Kent [ ] 02= Keitt [ ] 03= Palmer [ ] 04= Other (Specify) [ ]

B.03 Where do you sell your mangoes?

01= Distributor's residence [ ], 02= Local market [ ], 03=Wholesalers market within the district [ ], 04= Other (Specify) [ ]

B.04 What is the unit of sale? 01= Box [ ] 02= Bag [ ] 03= Kilo [ ] 04= Other (Specify) [ ]

B.05 Do you export your produce to any foreign country? 1= Yes [ ], 2= No [ ]

B.06 Which of these marketing outlets do you sell to?

g) Local market [ ]
h) Supermarkets [ ]
i) Contract buyers [ ]
j) Foreign market [ ]
k) Processing factors [ ]
l) Other (Specify) [ ]

B.07 What informs your choice of specific marketing channel?

a. Higher price [ ]
b. Reduced Cost [ ]
c. Reliable customer [ ]
d. Distance to market [ ]
e. Number of buyers [ ]
f. Quantity/volume bought [ ]
g. Other (Specify) [ ]

Value Addition

B.06 What activities do you perform on the produce before selling to the buyer?

Activities	Yes/No
Sorting/ Packaging	
Cleaning	
Drying	
Other	

SECTION C: REVENUE

a. Fixed cost:

C.1 Indicate the cost, quantity, year of purchase and lifespan of farm inputs you use for your mango production?

Implements/ equipment	**Quantity**	**Years of purchase**	**Cost of purchase**	**Lifespan of input**
Truck				
Crate/Boxes				
Storage facility				
Basket				

b. Labour cost

C.02

Operation cost inputs (labour in man days)	Number of family labour	Number of hired labour	Unit cost
- Loading charge - Offloading			

Processing cost/beg/box - Cleaning - Grading			

C.03a Do you belong to any distributors/trade association group in your community? 01= Yes 02= No

C.03b If yes, in which way does the group help you in your trade activities? ……..

C.03c What additional service should they provide? ……

	Production year	
	2019	2020
C.04 What was the total quantity of mango bought in the following years? .....(Kilograms)		
C.05 What quantity of mango did you sell? …….		
C.06 Please state how much you received after sale of mango in the 2019 & 2020 season? ……		
C.07 What was your unit price in the year 2019 & 2020?	GH₵….	GH₵…….

C.08 If mangoes are sold outside the distributors residence what is the transport cost?

Marketing activity	**Cost**	
	2019	2020
Transport charge of mango from farm to market		
T&T of farmers from farm to market		
Storage charge at market place		
Other		

C.09 Please indicate the cost associated with the mango value-addition in the table below

Activities	Labour		Cost		Total cost/week	
	2019	2020	2019	2020	2019	2020
Sorting/grading						
Cleaning						
Packaging						
Drying						
Other						

SECTION D: RELATIONSHIP AMONG OTHER MANGO ACTORS

D.01a Is there any contract between you and other actors?

01= Yes 02= No

D.01b If yes, what type of contract? 01= Verbal contract 02= Written contract 03= Other (Specify)……

D.01c Indicate the nature of the contract by responding Yes/No to the following questions

Package in the contract	**Yes/No**
Provision of input(s)	
Provision of credit	
Provide transport	
Provide technical support	
Other (Specify)	

D.02 Which of the factors mentioned above will you consider before selling on a contract basis?

……

SECTION E. IMPACT OF COVID

E.01 The outbreak of COVID-19 pandemic impacted negatively on sales of many mango distributors?

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.02 The sales of mango increased during the outbreak of the COVID-19 pandemic as compared to previous year sales.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.03 The outbreak of COVID-19 pandemic impacted negatively on the availability of labour.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.04 The Pandemic made a lot of distributors incur a lot of cost in transporting their mango fruit to the market.

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.05 In which way did mitigation strategies like travel restrictions, ban on social gathering and export affected your mango business

1= Positively [ ], 2= Negatively [ ]

E.06 Did customers demanded the adherence to COVID-19 protocols before buying your fruits?

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.07 Mango distributors experienced post-harvest losses during the during the outbreak of COVID-19 because there were insufficient buyers?

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.08 Some mango distributors reduced price to minimize their fruit wastage.

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.09 Customers/buyers bargained for low prices during the outbreak of COVID-19.

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.10 Mango distributors increased price of the fruit because there was high demand during the outbreak of COVID-19?

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.11 Did you experience higher transportation cost due to transport restrictions during the COVID-19 pandemic?

1= Yes, 2= No

E.12 Did you have to add value to your fruits packaging due to keen attention of customers to quality and appearance during the COVID-19 pandemic?

1= Yes, 2= No

E.13a Did you receive any support from government or NGO during the COVID-19 outbreak in quest to ease the impact of the outbreak on your activities?

3. Yes

4. No

E.13b If Yes, what support did you receive? ……

E.14 Did the outbreak of COVID-19 pandemic affected your trade with producers and consumers?

1= Yes, 2= No

E.15 Has your mango fruits being rejected by your customers during the outbreak of COVID-19 due to quality and fear of contracting the virus?

1= Yes, 2= No

E.16 Were you prevented from transporting your mango fruit to the urban area during the lockdown of the COVID-19 pandemic?

1= Yes, 2= No

E.17 Did you have to observe any COVID-19 protocols before bringing the fruit to the urban centers?

1= Yes, 2= No

SECTION F: MARKET INFORMATION ACCESS & DISSEMINATION

1. Do you have access to market information? (a) Yes [ ] (b) No [ ]
2. Mentioned at least five actors from whom you can access market information.
3. Where to you get the market information from (a) Colleague farmers (b) FBOs (c) AEA of MoFA (d) Wholesalers (e) Retailers (f) Exporters (g) GEPA (h) GSA
4. Who are the closes stakeholders do you disseminate market information to?
5. Do you receive training from any agricultural support institutions mentioned earlier? If Yes, name the kind of training programme you receive.
6. During this training programmes, are market information about price, demand and supply trends and quality discussed?
7. Do the market information acquired helpful in your distribution and marketing? (a) Yes (b) No

GOVERNANCE STRUCTURE

G.01 Who determines the price of the mango fruit. 01. Buyer [ ] 2. Seller (you) [ ] 3. FBO [ ] 4. Other (Specify) [ ]

G.03 At what price do you buy the mangoes from your supplier?

Box (Unit)……

G.04 What is the level of your "importance and influence "in the mango value chain in regards to the following indicators.

	Producers	Distributors	Processors
Profit			
Bargaining power			
Information concentration			

SECTION H: THE CONSTRAINTS FACED BY THE DISTRIBUTORS (WHOLESALERS & RETAILERS)

G.01 How would you rate the following constraints you are facing in your mango business? On a scale of 1 –9 where 1 is the most pressing constraint and 9 is the least pressing constraint.

Code	Please answer by choosing between 1 – 9 based on the strength of the proposed challenge	Rank
H1	Poor road network	
H2	High cost of transportation	
H3	Unreliable source of supply due to COVID-19	
H4	Lack of storage/pack house facility	
H5	Price fluctuation due to COVID-19	
H6	Indifferent preference by consumers	
H7	Incidence of diseases	
H8	Lack of access to current source of information	
H9	Reduced demand for mango fruit due to COVID-19	

QUESTIONAIRE FOR AGRO-PROCESSING FIRMS

This study titled ***COVID-19 AND THE MANGO VALUE CHAIN IN THE SOUTHERN PART OF GHANA*** and is been carried out by BRIGHT KETADZO, a graduate student at the University of Ghana, Legon in partial fulfillment of the requirements for the award of Master of Philosophy degree in Agribusiness. He is soliciting information for this study and need your consent. Your survey responses will solely be for academic purposes and will be highly confidential. Your support and contributions will be very much appreciated.

Name of processing firm ……..... Name of respondent: ……..

Location:	|.....|….|….|	Position of Respondent (Operation Manager, Marketing head, Sales head, other):…….	
Region name:	……..	Telephone number:	|…|…|…|…|…|…|…|…|…|…|…|
District:	|.....|….|	Date of interview:	|.....|...….|…….|
		Name of Enumerator:	……..
No. of years firm has been in operation: ……..			

SECTION A: PROCESSING

A.01 What product of mango do you process? 01= Mango juice [ ] 02= Cut Mango [ ] 03= confectionary (Jam, cakes, etc) [ ]

A.02 How many tonnes of mango do you use to process a unit/kg of these products?

1= Mango juice……. 2= Cut mango…… 3= Confectionary (jams, cakes etc)……..

A.04 How many times do you process mango within a week?.....

A.05 What is the output level of processed product obtained in a week? (Please indicate units) .....

A.06 What are the source(s) of the mango you process and who are the major buyers of your processed products (output channel)?

Major source (Suppliers) (Please state Region(s))	Output channels (Buyer) (State region if possible)

A.07a Do you obtain your raw material (mango fruit) from outside Ghana? 1= Yes, 2= No

A.07b If yes, which of these reasons supports your decision to source your raw material from other countries? state reason(s)……

A.08 Which of these do you supply your mango products to? 1= General market [ ], 2=Schools [ ], 3= Restaurant & Hotel [ ], 4= Public institutions [ ], 5= Other(Specify) [ ]

A.09 What informs your choice of specific marketing channel?

h. Higher price [ ]

i. Reduced Cost [ ]
j. Reliable customer [ ]
k. Distance to market [ ]
l. Number of buyers [ ]
m. Volume bought [ ]
n. Other (Specify) [ ]

SECTION B: RELATIONSHIP AMONG MANGO PROCESSORS AND OTHER ACTORS

B.01a Is there any contract between you and your suppliers?

01= Yes 02= No

B.01b If yes, what type of contract? 01= Verbal contract 02= Written contract 03= Other (Specify)……

Indicate the nature of the contract by responding Yes/No to the following questions

Nature of contract	**Yes/No**
Provision of input(s)	
Provision of credit	
Provide transport	
Provide technical support	
Other (Specify)	
Terms of contract	
Clearly specify the product under consideration	
State the time of delivery	
Specify the responsibilities of both parties	
Clearly established prices, payment obligations and other financial issues	
Price adjustment for variations in quantity and quality of produce	

B.02 Which of the factors mentioned above will you consider before selling on a contract basis?

……

SECTION D:

COST OF PROCESSING

a. Fixed costs

Fixed Cost Inputs	Quantity	Cost (GHS)	Useful life (in years)
a. Processing machine			
b. Crusher			
c. Plastic drum			
d. Pasteurizer			
e. Cooking machine			
f. Wrap machine			
g. Thermos (ice chest)			
h. Cartons			
i. Other			

b. Variable cost

Variable input cost	Quantity		Cost per unit	
	2019	2020	2019	2020
a. Mango				
b. Water				
c. Electricity				
d. Bottles				
e. Corks				
f. Labels				
g. Other (specify)				

Operation cost

Operation cost	Number of times	Weekly wage for each (GHS)		Total cost (GHS)	
		2019	2020	2019	2020
Purchasing cost of mango - Loading - Offloading					
Transport charge					
Washing					
Peeling					
Cutting					
Crashing					
Extraction of juice					
Packaging					

Other (Specify)……..					

c. REVENUE

D.01. How do you market your products? ……..

D.02. What kind of packaging do you use?.....

D.03. Do you weigh your products? 01= Yes 02= No

D.04. What is the unit of sale? 01= Bottle 02= Gallon 03= Other (Specify)……..

D.05. At what price do you sell product to your buyer(s)?

Products	Total output (Kg)/week		Unit price (GHS)	
	2019	2020	2019	2020
Mango juice				
Cut mango				
Confectionary				

D.06. How do you perceive the importance of the factors to customers in relation to buying mango products?

	1= very important	2= important	3= very Unimportant	4= unimportant	5= Neither important or unimportant
Taste					
Price Package					
Proximity					
Availability					
Nutrients					
Aroma(scent)					

SECTION E. IMPACT OF COVID

E.01 The outbreak of COVID-19 pandemic impacted negatively on the number of labour force at the processing unit of your company?

iii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.02 The outbreak of COVID-19 pandemic impacted negatively on the marketing of the processed mango of many mango processors?

i. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.03 The outbreak of COVID-19 pandemic impacted positively on your product.

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.04 The Pandemic made you lose customers?

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.05 The sales of your product increased during the outbreak of the COVID-19 pandemic as compared to previous year sales.

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E.06 Mango processors increased price of their products because there was high demand during the outbreak of COVID-19?

ii. Strongly agree [ ] ii. Agree [ ] iii. Moderate [ ] iv. Strongly disagree [ ] v. Disagree [ ]

E. 07 Did the quantity of mango fruit you buy reduced as a result of the outbreak of the COVID-19 pandemic?

1. Yes
2. No

E.08a Did you receive any support from government or NGO during the COVID-19 outbreak to ease the impact of the outbreak on your activities?

8. Yes
9. No

E.08b If Yes, what support did you receive?

E.09 Has your mango fruits being rejected by your customers during the outbreak of COVID-19 due to quality and fear of contracting the virus?

1= Yes, 2= No

E.10 Did you have to observe any COVID-19 protocols before bringing the fruit to the urban centres?

1= Yes, 2= No

F. MARKET INFORMATION ACCESS & DISSEMINATION

8. Do you have access to market information? (a) Yes [ ] (b) No [ ]
9. Mentioned at least five actors from whom you can access market information.

10. Where to you get the market information from (a) Colleague farmers (b) FBOs (c) AEA of MoFA (d) Wholesalers (e) Retailers (f) Exporters (g) GEPA (h) GSA
11. Mention the various stakeholders you disseminate market information to.
12. Do you receive training from any agricultural support institutions mentioned earlier?
    If Yes, name the kind of training programme you receive.
13. During this training programmes, are market information about price, demand and supply trends and quality discussed?
14. Do the market information acquired helpful in your production and marketing? (a) Yes (b) No

SECTION G. GOVERNANCE STRUCTURE

F.01 Who determines the price of the mango fruit? 01. Buyer [ ] 2. Seller (you) [ ] 3. Other (Specify) [ ]

F.02 At what price do you buy the mangoes from your supplier?

Box (Unit)……

F.03 What is your level of satisfaction for the prices you receive for the mango? 1. High [ ] 2. Medium [ ] 3. Low [ ]

F.04 What is the level of your "importance and influence "in the mango value chain in regards to the following indicators.

	Producers	Distributors	Processors
Profit			
Bargaining power			
Information concentration			

SECTION H. THE CONSTRAINTS FACED BY THE DISTRIBUTORS (PROCESSORS)

How would you rate the following constraints you are facing in your mango business? On a scale of 1–9 where 1 is the most pressing constraint and 9 is the least pressing constraint.		
Code	Please answer by choosing between 1 – 9 based on the strength of the proposed challenge	Rank
H1	Poor road network	
H2	Poor quality of raw material	
H3	High cost of raw material due to COVID-19	
H4	Unreliable source of supply	
H5	Unreliable source of raw material	
H6	High cost of labour	
H7	Competition from other processors	
H8	Reduced demand for processed mango fruit due to COVID-19	
H9	Other (specify)	

Table 1A
Multinomial logistic regression for farmers

Choiceofmarketingc~l	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Gendercode	-.562	.694	-0.81	.419	-1.923	.799	
Ageofrespondent	.003	.023	0.15	.883	-.042	.049	
Maritalstatus	.064	.832	0.08	.938	-1.566	1.695	
Highcosttofarminpu~o	1.149	.95	1.21	.227	-.713	3.012	
Higherprice	-.55	.632	-0.87	.383	-1.788	.688	
Quantityintonnes2019	.047	.02	2.41	.016	.009	.086	**
Quantityintonnes2020	-.029	.016	-1.75	.08	-.061	.003	*
Reliablecustomer	-2.747	1.165	-2.36	.018	-5.031	-.464	**
FBOmembership	.72	.739	0.97	.33	-.728	2.168	
Farmsize	.172	.051	3.35	.001	.071	.273	***
Constant	-2.236	1.289	-1.73	.083	-4.763	.29	*
Gendercode	-1.298	.482	-2.70	.007	-2.243	-.354	***
Ageofrespondent	.016	.016	0.97	.331	-.016	.048	
Maritalstatus	1.337	.701	1.91	.056	-.036	2.711	*
Highcosttofarminpu~o	.884	.709	1.25	.213	-.506	2.274	
Higherprice	.126	.464	0.27	.787	-.783	1.034	
Quantityintonnes2019	.044	.018	2.48	.013	.009	.079	**
Quantityintonnes2020	-.029	.014	-2.09	.037	-.057	-.002	**
Reliablecustomer	-1.07	.586	-1.83	.068	-2.217	.078	*
FBOmembership	.827	.486	1.70	.089	-.126	1.779	*
Farmsize	.142	.046	3.09	.002	.052	.233	***
Constant	-2.499	1.044	-2.39	.017	-4.545	-.453	**

Mean dependent var	1.900	SD dependent var	0.932
Pseudo r-squared	0.232	Number of obs	150
Chi-square	68.321	Prob > chi2	0.000
Akaike crit. (AIC)	269.562	Bayesian crit. (BIC)	335.796

*** p<.01, ** p<.05, * p<.1

Multinomial logistic regression for Distributors

Choiceformarketing~t	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
	0	.	.	.	.	.	
Ageofrespondent	-.024	.038	-0.64	.522	-.099	.05	
Educationbackground	.791	.635	1.25	.213	-.454	2.036	
Maritalstatus	1.411	.684	2.06	.039	.07	2.752	**
Membershipofanasso~n	.182	.839	0.22	.828	-1.463	1.827	
Reliablecustomers	16.338	1.88	8.69	0	12.654	20.022	***
Higherprice	16.423	1.906	8.62	0	12.688	20.158	***
Numberofbuyers	-16.837	2.373	-7.10	0	-21.487	-12.187	***
Owntransport	18.719	1.875	9.98	0	15.044	22.395	***
Valueaddition	-.357	.889	-0.40	.688	-2.099	1.385	
Region	-.064	.566	-0.11	.91	-1.174	1.046	
Constant	-18.517	2.449	-7.56	0	-23.317	-13.717	***
Ageofrespondent	-.029	.058	-0.49	.624	-.143	.086	
Educationbackground	-.583	.619	-0.94	.346	-1.797	.631	
Maritalstatus	.487	.732	0.66	.506	-.948	1.922	
Membershipofanasso~n	.417	.839	0.50	.62	-1.228	2.061	
Reliablecustomers	16.283	1.48	11.00	0	13.383	19.183	***
Higherprice	16.256	1.506	10.80	0	13.305	19.207	***
Numberofbuyers	-16.983	1.828	-9.29	0	-20.566	-13.4	***
Owntransport	-2.026	1.257	-1.61	.107	-4.49	.438	
Valueaddition	-.447	1.012	-0.44	.659	-2.432	1.537	
Region	-.65	.571	-1.14	.255	-1.769	.469	
Constant	-15.352	2.123	-7.23	0	-19.513	-11.19	***

Mean dependent var	0.550	SD dependent var	0.769
Pseudo r-squared	0.147	Number of obs	60
Chi-square	725.253	Prob > chi2	0.000
Akaike crit. (AIC)	138.999	Bayesian crit. (BIC)	185.074

*** p<.01, ** p<.05, * p<.1

Multinomial logistic regression for Processors

Choiceofmarketchan~l	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Gender	22.734	3.977	5.72	0	14.94	30.528	***
Ageofrespondent	.523	.193	2.71	.007	.145	.9	***
Higherprice	.303	2.18	0.14	.889	-3.969	4.575	
Volumebought	2.633	1.435	1.83	.067	-.179	5.446	*
Periodofpayment	-1.332	1.678	-0.79	.428	-4.621	1.958	
Numberofbuyers	-.759	1.391	-0.55	.586	-3.486	1.969	
Reliablecustomers	.111	1.519	0.07	.942	-2.866	3.088	
Distancetomarket	.289	2.183	0.13	.895	-3.99	4.568	
Constant	-21.482	7.446	-2.88	.004	-36.077	-6.887	***
Gender	24.374	5.126	4.76	0	14.328	34.421	***
Ageofrespondent	.44	.177	2.48	.013	.093	.788	**
Higherprice	-15.845	2.704	-5.86	0	-21.145	-10.544	***
Volumebought	2.438	2.02	1.21	.227	-1.521	6.398	
Periodofpayment	-3.013	2.635	-1.14	.253	-8.178	2.152	
Numberofbuyers	16.674	2.042	8.17	0	12.673	20.676	***
Reliablecustomers	17.291	1.269	13.63	0	14.804	19.777	***
Distancetomarket	.878	2.877	0.31	.76	-4.761	6.517	
Constant	-35.537	7.536	-4.72	0	-50.307	-20.767	***

Mean dependent var	0.767	SD dependent var	0.774
Pseudo r-squared	0.544	Number of obs	30
Chi-square	1570.819	Prob > chi2	0.000
Akaike crit. (AIC)	64.779	Bayesian crit. (BIC)	90.000

*** $p<.01$, ** $p<.05$, * $p<.1$