Farmers' motivation for participating in inter-organizational relationships in Ghana

by

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B.S., University of Ghana, 2008
M.S., University of Bonn, 2012

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics
College of Agriculture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2020

Abstract

Interests in inter-organizational relationships in the Ghanaian agri-food sector has been stimulated in recent years by policies seeking to reduce farmers' market risks while improving processors' access to required agricultural products. The decision of how to sell farm produce is an economic imperative for the farmer. The coexistence of spot markets and relationships suggests therefore that farmers must be having some gains from them. This study sought to provide an understanding of the factors that motivate farmers to participate in inter-organizational relationships and the hierarchy of such relationships in terms of incremental revenue. It was based on the hypothesis that reducing transaction costs increases the likelihood of farmers' participation and also that farmers who produce perishable crops are more likely to participate. Primary data were collected from 354 farmers producing various crops in Ghana. The study found that 55% of farmers use spot markets while about 45% were involved in formal relationships with their buyers. Nearly two-thirds of these participating farmers had direct relationships with their customers, while the remaining third engaged through their farmer association or collective. Product quality was the focus of most of the relationships, with price and quantity being lower motivators for formal relationships. Although the relationships were all formal, in the sense that both parties were cognizant of the terms of engagement, it was discovered that the majority were governed by informal arrangements.

Transaction costs were defined as information availability, price, and sales certainty. The results showed that increasing information availability, price certainty, and sales certainty increased the likelihood of farmers' engaging in formal relationships with buyers. Because fruits are highly perishable, getting selling agreements in place reduces fruit farmers' risks. Therefore, fruit farmers are more likely to participate in formal relationships. On the other hand, grains, such as maize and

legumes, have long shelf lives, and therefore, farmers of these commodities have less motivation to participate in formal relationships. The results showed that the odds ratio of fruit farmers relative to non-fruit farmers choosing to participate in relationships was 4.416 times higher at the 1% significance level.

The incremental revenues indicated that maize farmers were better off developing their relationships directly with the buyer however, the choice of the focus area and the governance mechanism made no difference. Cassava farmers were also better off developing their relationships directly with the buyer, focusing on price-quality or price only specifications and using formal agreements to govern their relationships. For cocoa farmers, any method they used to develop and govern their relationships made no difference in terms of incremental revenue, however, they were better off focusing their relationship on price-quality or price only specifications.

This study's results suggest that policy initiatives to support relationships between farmers and buyers must focus on promoting transparency and ascertaining sales and prices of participating farmers. It must also be focused particularly on farmers of perishable commodities like fruits. This study has provided the understanding that information availability, price, and sales certainty, as well as the perishable nature of commodities, motivate farmers to participate in formal relationships. These policy initiatives, should, therefore, enhance participation and the gains of farmers in inter-organizational relationships.

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Acknowledgements

The intensity of work, tenacity, and resources required to complete a PhD are profound and will only be a mirage without the assistance of dedicated professionals, colleagues, and friends.

By the grace of God, I have been able to complete my PhD in a record time of less than three years. I would like to express my sincerest gratitude to my major professor, Dr. Vincent Amanor-Boadu, the kind that any PhD student would be fortunate to have. I came to Kansas State University because I got to meet Dr. Amanor-Boadu while he was about his business in Ghana. Having shared my research interest with him, I was impressed with his insights, enthusiasm, ability to engage and his confidence. I had been in a faculty position for four years before my PhD so I knew what value I needed. Through the years of conversation with Dr. Amanor-Boadu, he has stimulated my ability to think and ask questions creatively as well as improve my writing skills. I recall the many hours he spent guiding me in my data-collection instruments. He was there with me in Ghana while I trained my enumerators, teaching me the nuances of managing people. I am grateful to him for keeping my motivation lighted. I thank him for his ability to recognize stress or disappointment in any form and knowing how to encourage. From him, I learned how to be a good supervisor, a quality I believe will be useful throughout my professional life.

I would also like to thank my committee members, Dr. Alex Shanoyan, Dr. Kara Ross, and Dr. Philip Gayle, for their perspectives and contributions, which helped sharpen this research. I benefitted from Dr. Shanoyan's course on *Agribusiness Industry Structures*, which gave me insights and clarity of some underlying constructs used in this research. I am thankful to Professor Fadi Aramouni for his role as the external chairperson of my dissertation defense.

I would like to extend my gratitude to my colleagues for their support and friendship, and to all the staff of the Department of Agricultural Economics at Kanasas State University. I would

like to especially recognize Judy Duryee, Amy Schmidt, Mary Winnie, and Deana Foster for their constant support and willingness to help me unfailingly.

A special thank you to all my American friends: Laurie; Joyce and Dick; Jo and John; Kaye and Chuck; and my German friend, Annette Maclellan. We did share some wonderful times in Manhattan, Kansas.

My PhD was sponsored by the BHEARD program operated by the United States Agency for International Development, as part of the Feed the Future initiative, and was managed under the CGIAR Fund, Award Number BFS-G-11-00002, and the predecessor fund the Food Security and Crisis Mitigation II grant, Award Number EEM-G-00-04-00013. I am grateful to the American people for investing in my professional development.

Dedication

To the Lord Almighty, for I know "… it is not of him that willeth, nor of him that runneth, but of God that sheweth mercy" (The Holy Bible: Romans 9:16 (King James Version)).

To my parents, Frank Gyebi and Mary Andoh-Gyebi for their unparalleled support during my study abroad, especially in taking care of my three boys, who made sure that their 'grandparents' title was earned.

To my only sister, Gloria-Grace, and her family for their voluntary services and many errands ran for me. The title of "younger sister" is earned and I do appreciate everything you have done.

To my three sons, John, Jeremy, and Jason, for their patience as they marked the calendar each day in expectation of my return. For such questions as, "Are there no schools in Ghana?" I will have a better answer someday.

To Eben, my precious and faithful husband, who was not afraid to release an ambitious wife to chase the golden fleece. For his unflinching support, for the times he hung in there while I juggled my time, for his motivations and optimism that lighted the dark times, I will forever be grateful.

Chapter 1 Introduction

1.1. Background

Inter-organizational relationships refer to the way firms connect to achieve their individual or mutual objectives. When the participating firms are at different stages in the supply chain, the relationship may be described as a vertical relationship. When the participating firms are at the same stage in the supply chain, then the relationship is described as a horizontal relationship. Firms may participate in both vertical and horizontal relationships at the same time. Often, horizontal relationships, such as farmer cooperatives and other farmer-based organizations, are formed to provide farmers the critical mass to engage downstream or upstream in their supply chain. Vertical relationships are often formed to reduce embedded and inherent transaction costs in the market place that are perceived to disadvantage their participants.

The decision of how to sell farm produce is an economic imperative for the farmer. Farmers sell their products to potential buyers using different methods, from spot market transactions to more enduring relationships. A farmer who chooses to sell by spot market transactions can be described as one who completes production decisions; finds a buyer after harvesting and sells the farm produce at the prevailing market price. This farmer and the buyer aim to satisfy their self-interests, hence changing transaction partners can be spontaneous (Amanor-Boadu & Martin, 1992; Peterson, Wysocki, & Harsh, 2001; Sporleder, 1992). The farmer using this spot market is referred to as a non-participant in inter-organizational relationships. Contrariwise, a participant in inter-organizational relationships is the farmer who chooses to engage a buyer in a more enduring relationship to sell their farm products. Such relationships are associated with the performance of specific tasks in exchange for specific benefits that are known before sale transactions occur.

Farmers' relationships can be delineated based on how they are developed, the focus areas and the governance mechanism in the relationship (Holmlund & Törnroos, 1997). They may develop direct relationships with their buyers, develop their relationships through their farmer-based organizations, or they may develop their relationships through an agent (an individual or a company that acts on behalf of the farmer). Farmers may also focus their relationships on various aspects of the farm products or the production process that influence volumes, quality or prices. To ensure accountability, some formal or informal agreements may be used to govern the relationship.

Interests in inter-organizational relationships have been stimulated in Ghana in recent years by policies seeking to reduce farmers' market risks while improving processors' access to agricultural products meeting desired quality and availability (MoFA, 2007; 2017). They are premised on the belief that spot market transactions do not favor farmers given the sector's asymmetric information structure. The assumption is that the participatory and negotiated process needed for farmers' relationships could reduce farmers' disadvantage in the sector's asymmetric information situation (Wagner, 2015). The risks of asymmetric information are exacerbated by power imbalance in the market (Amanor-Boadu et al., 2002). Ghanaian farmers' average landholding is about 4 ha and agri-food produce buyers often demand high volumes of output from several hundred hectares. This makes most farmers vulnerable in spot market exchanges, supporting the need to enter relationships with produce buyers (Yuh-Wen et al., 2005).

Regardless of the potential for relationships to overcome some of the challenges that spot markets pose to farmers, there is the recognition that, given the situation, such relationships may not be necessary (Macdonald et al., 2004; Mighell & Jones, 1963). Consider farmers producing fruits or grains as an example. Fruits are perishable and lose substantial value if sold earlier or

later. Suppose the fruit farmer decides to sell by spot market transactions, they stand one of the two-possible risks: (1)spending time and effort to search for a buyer while the fruits deteriorate or (2) selling them in the freshest state to the first buyer who knows the farmer has no immediate alternatives and offers a low price. However, if the fruit farmer decided to rather arrange a relationship with the buyer, they could avoid these risks. Grains, on the other hand, are non-perishable and store well. The farmer who produces grains does not stand the risk of products deteriorating while searching for buyers and is not vulnerable to opportunistic buyers since the grains can easily be stored. This situation may allow the grain farmer to cope with the uncertainties of spot market transactions to his advantage. The central challenge here is developing relationships that are appropriate for farmer's needs. The transaction costs theory creates the avenue and possibility for understanding the farmers' motivation for participating in inter-organizational relationships in Ghana and to give a basis for policymaking (Coarse, 1937; Coase, 1988; Williamson, 1975).

Farmers' relationships, when considered in the light of transaction costs, have the potential to trigger different economic implications for both farmers and buyers of the farmers' produce. Transactions cost theory, unlike neoclassical economics, recognizes that the cost of economic activities is raised by human and transactional factors. The central concepts to the study of transaction costs include search costs; the cost of opportunistic behaviors; and the cost of preventing opportunistic behaviors. The underlying assumptions which give impetus to these transactions' costs are bounded rationality, information asymmetry, difficulty in measuring performance, uncertainty, asset specificity and a smaller number of trading partners. Uncertainty in economic activities could impede the rationality of the farmer and also the decisions of the farmer can only be in the bounds of the information available to him. The small number of trading

partners indicates fewer alternatives for the farmer hence defining a power disparity situation. The benefits of economic activity will be improved by reducing these costs (Williamson, 1975; 1985a).

Human action economics is another theory recruited to explain the farmers' decisions regarding inter-organizational relationships. This theory asserts that human action is purposeful behavior (Von Mises, 1966). Farmers' decisions are therefore conscious and based on rational considerations. A study in Zambia portrays this as it showed how farmers altered their cropping patterns in response to changes in the climate patterns for 46years (Amanor-Boadu, 2010).

Given these theories, the study is premised on the assumption that certain pecuniary factors, non-pecuniary factors, farmer's socioeconomic and crop enterprises may be at play in shaping farmers' choice of how to sell their farm produce. This research, therefore, seeks to determine the motivating factors for farmers' participation in inter-organizational relationships.

1.2. Problem Statement

Spot market transactions have been the traditional method for farmers to sell their products but in recent years, inter-organizational relationships have become part of the gradual shift to the goal of modernized agriculture and a structurally transformed economy in Ghana (MoFA, 2007; 2015; 2017; NDPC, 2005). How policymakers have understood farmers gain from such relationships with buyers has affected how they have addressed it in this paradigm shift. The problem confronting this research is that inter-organizational relationships may not be valued by every farmer and the typology of relationships may differ among farmers who value inter-organizational relationships. By the transaction cost theory of the firm (Williamson, 1975, 1985a), it is plausible to argue that the value perceived by firms involved in an inter-organizational relationship is greater than the value of not participating. In the same token, those with the option

to participate and choose not to participate may be perceiving the value emanating from their participation to be lower than their participation costs. Understanding the perceptual and other factors leading to participation choices can help both firms and public policy decision-makers nurture appropriate strategies to achieve private and public economic objectives.

1.3. Research Question

An emerging research question from the foregoing research problem is this: What factors motivate farmers who participate in inter-organizational relationships and to what is the hierarchy of the relationships based on incremental revenue?

The answer to the research question will provide insights into policies that may be implemented to support farmers' ability to fully exploit these inter-organizational relationships to achieve their economic objectives while minimizing the challenges they present. They would also help relationship champions identify potential partners that present the best fit to facilitate the achievement of their strategic objectives for their relationships.

1.4. Research Objectives

The main objective is to find out what factors motivate farmers to participate in inter-organizational relationships and the hierarchy of the relationships based on incremental revenue. The specific objectives are as follows:

1. Identify and classify the typologies of inter-organizational relationships in which farmers participate to sell their farm products in Ghana
2. Estimate and compare the net benefits associated with the farmers' participation in inter-organizational relationships in Ghana

3. Estimate the hierarchy of the typologies of inter-organizational relationships in terms of incremental revenue in Ghana.

1.5. Overview of Methods

Objective 1 was achieved by using tables, charts, and percentages to describe the various typologies of inter-organizational relationships that exist among the farmers. Objective 2 was achieved through the estimation of a binary logit model using primary data collected from farmers in Ghana. The binary outcome variable was participation in inter-organizational relationships (1 if the farmer participates in relationships and 0 if the farmer sells in the spot market). The multinomial logit is also used to explain factors determining how farmers developed their relationships. Objective 3 was achieved by estimating the incremental revenue, price premium, and proportion of farm products sold in the various typologies of relationships.

1.6. Dissertation Outline

This dissertation is divided into five chapters. Chapter 1 introduces the study; it provides the background and motivation for the research. It defines the problem that inter-organizational relationships may not be valued by every farmer and the typology of such relationships may differ among farmers who value inter-organizational relationships. This problem led to the research question: what factors motivate farmers to participate in inter-organizational relationships and what is the hierarchy of these relationships based on incremental revenue? The overarching objective was to find out the factors that motivate farmers to participate in inter-organizational relationships and what the hierarchy of the relationships was in terms of incremental revenue

Chapter 2 provides a systematic literature search and review on the theme, what are inter-organizational relationships and what do they mean for farmers? In chapter 3, the methodological approaches are developed. It includes the theoretical framework and its empirical application, the method of data analysis, sampling, study area, and data. Chapter 4 presents the results and discussion of the research objectives; identified typologies of inter-organizational relationships that exist among farmers; farmers motivating factors for participating in inter-organizational relationships; the hierarchy of inter-organizational relationships based on profitability. Chapter 5, which is the last, presents the summary, discussion and policy recommendations for enhancing the effectiveness of policies.

Chapter 2 What are inter-organizational relationships and what do they mean for farmers?

2.1. Background

Inter-organizational relationships become an option when markets fail (Fisher & Hartmann, 2010; Fisher, 1997; Williamson, 1975). In agriculture, the seasonal nature coupled with characteristics of farm products may present uncertainties that make the market less efficient as discussed in the previous chapter. The farmer wants to be able to sell his products and at a price, he deems fit. Buyers of the farmers' produce such as processors, wholesalers and trade associations want the right product available whenever they are needed. The overall importance of inter-organizational relationships in overcoming some of the challenges of the spot market is well recognized. However, given the coexistence of spot market and farmer-buyer relationships, the question of what drives farmers into such relationships arises from the literature.

The literature review covers the definition of inter-organizational relationships, introduces the farm as an organization, and describes the market structure and characteristics of the farmers' crop. It also provides a review of empirical research in the area of inter-organizational relationships as well as the gaps in the literature. The review finally presents the contribution of this study to the literature.

2.2. Defining inter-organizational relationships

"You can't create an enduring business by viewing relationships as a bazaar activity – in which I try to get the best of you and you of me – or in which you try to pass off as much

risk as you can to the other guy. Rather we must view relationships as a coming together that allows us to do something… – something that makes the pie bigger and is to your advantage and to my advantage". **British Petroleum's John Browne in (Prokesch, 1997, p154)**

Relationships have been defined as sustained interactions between actors which is based on mutual effort and agreements (Ford, 2003; Holmlund & Törnroos, 1997; Ritter, 2007). Relationship in this sense is not a one-time transaction but the transactions that occur over time. This also means that each transaction is based on former transactions and the expectation of transactions in the times ahead (Pilling, Crosby, & Jackson, 1994). Heide and John (1990) conceptualize that the expectations of further transactions between the parties give impetus to the characteristic investments often associated with relationships which are referred to as relationship-specific investment (Pilling et al., 1994). For they have less to no value outside of the relationship for which they were made.

The fundamental definition of an organization has been shown to include the ingredients "elements", "relations" and a "whole" by Krikorian (1935) in the Journal of Philosophy. He defines an organization as "a manifold of elements, each element being distinct in a set of relations forming a whole" (Krikorian, 1935). Eighty years down the line, Child (2015), argues that this definition – which in his own words is " all the attributes of a collective body taken as a whole" – is a great source of confusion as it makes companies or institutions tantamount to "organizations" i.e. with specific character and identity. In his definition of an organization, Child (2015), argues that the process of arranging collective effort with people or groups focused on different activities to achieve an outcome is organizing and the manifestation of it is organization. Hence he talks of

the “ the organization of a specific company”. Two schools of thought are therefore apparent, organization as an entity and organization as a tool.

Between the times of Krikorian and Child, evidence shows that there is little consensus on what organization means. There have been some proponents of the organization as an instrument and organization as an entity. Gaus (1937), one of the earlier proponents of the organization as an instrument defines the organization as " the arrangement of personnel for facilitating the accomplishment of some agreed purpose through the allocation of functions and responsibilities.” This direction is followed by others (Bittner, 1965; Selznick, 1948). The view of organizations as an entity is supported by Kotler (1972) in his work on the generic concept of marketing and also by Fischer and Reynolds (2010). Others, however, present a middle ground more or less (Ulrich, 1997). Organization theorists have recognized diverging thoughts and the need for a point of synergy (Astley & de Ven, 1983; Gouldner, 1959). The decision of which concept to adopt is, however, incumbent on the researcher. This study, therefore, focuses on the organization as an independent entity composed of resources that interact with a profit-making objective.

Inter-organizational relationships may thus be defined as the enduring interactions that exist between two or more independent organizations to achieve a mutual objective which also meets their independent objectives. The prefix, inter, suggests that there is no such relationship in only one organization or should two or more organizations become “one” with regards to shareholding or coalescing. Inter-organizational relationships have been recognized to be those forms of interactions that lie between the two extremes, the markets, and hierarchies of Williamson (1975) thus, they are referred to as hybrids (Chaddad & Rodriguez-Alcalá, 2010; Hobbs & Young, 2000; Ménard, 2004). Inter-organizational relationships contrast with spot market transactions in which organizations seek to achieve selfish objectives. Thus, exchanges are atomistic and current

arrangements are immediately terminated once better options show up (Amanor-Boadu & Martin, 1992). They also contrast hierarchies or integration which is described as a single firm that takes on two or more stages of production and is characterized by internal transfer of resources (ibid, 1992).

2.2.1. The farm as an organization

A farm as a whole is composed of various resources, the farmer as the producer, the land and capital he buys or rents and the hired or family labor. The farmer mobilizes these elements to institute production aimed at making a profit. This institution that makes up a farm constitutes an organization as described in the literature as an entity (Keller & Holmes, 1928; Kotler, 1972; Krikorian, 1935). In many cases, there is a recognition that farmers do not realize their farm operations as a business and hence less responsive to economic possibilities (Keller & Holmes, 1928; Tolley, 1936). Farmers may produce crops for sale and consume what they do not sell. They may also produce for consumption and sell what they are unable to consume. The Ghana Living Standards Survey 6(GLSS), 2012-2013 and population census, (2010) have defined a farmer as one who owns or operates a farm for sale or for family consumption. Per this definition, it is reported that farmers in Ghana constitute about 51.5% and 45.8% of the population by the GLSS 6 and population census respectively (GSS, 2012; GSS, 2014). However, in this study, the focus is on crop farmers defined as those who produce any crops with the primary intention of commercializing them.

In the farm organization, the farmer has several decisions to make. Three of such decisions are discussed. First, the decision of what crop(s) to produce: this has been known to be influenced by the farmers' know-how and capabilities, availability of production factors and the relative

demand for the crops (Keller & Holmes, 1928). However, we know from the human action literature and some empirical studies that farmers will change their decision when conditions change (Amanor-Boadu, 2010; Von Mises, 1966). Second, is the decision of the means, method and scale of production: this has to do with whether the farmer wants to produce organic or conventional, capital-intensive or labor-intensive; whether he wants to buy or rent land and capital, hire labor or use family labor, and even whether to use equity or debt financing as well as what size to operate. The decision of the farmer comes with financial obligations for renting or buying land and capital, hiring labor and also for buying seeds, planting materials, chemicals, fertilizers, packaging, storage and transportation systems. The availability of funds could influence the decisions the farmer takes. The third and final which is of interest here is the farmers' relationship decisions to secure supplies for production and also to have market outlets for his farm products. This study is focused on the latter.

The farmers' decision on how to sell his products is an important one since his primary aim is to sell his farm produce to justify his investments and operations. The farmer may decide to sell his farm produce using spot market transactions, which is characterized by atomistic interactions and selfish gains with little predictability. Farmers may also decide to arrange a sustained interaction with buyers of the farm produce, which is characterized by mutual objectives that align with individual objectives. This describes an inter-organizational relationship between the farmer and the buyer. Relationships between farmers are arranged before sales transactions occur and are therefore capable of influencing the first two decisions of the farmer discussed (Pilling et al., 1994).

2.2.2. The Market structure and characteristics of farmers crops

Products and their markets come with various characteristics in terms of the nature of the products (bulkiness, perishability, functionality) and the trading partners. The Ghanaian market for the farmers' grains, root crops, tree nuts, fruits, and vegetables is discussed.

Grains belong to the family Gramineae. The most grown around the world are rice, maize, sorghum, wheat, and millet. Maize and rice are major grains produced in Ghana (MoFA, 2016). Dry grains are durable, easily handled, transported and they store well when given the right conditions. Hence they are not considered perishable. Maize in Ghana has the dual function of food for people and feeds for livestock. It is estimated that 85% of maize produced in Ghana is for human consumption and 15% is for animal feeding (Rondon & Ashitey, 2011). However, this may not be the case in other countries like the USA where maize is produced as a feed grain (Capehart & Liefert, 2017). The price of maize depends on the proximity to markets as well as the time of the year (Amanor-Boadu, 2011). Maize trade is dominated by many women traders, “market queens” who buy from farmers (Angelucci, 2012). Rice serves as food for people and constitutes an important staple in the Ghanaian diet. Ghana is a net importer of rice, importing more than half of the rice consumed (Ashitey, 2018). Rice is usually sold to private companies, aggregators and processors (Abdul-Rahaman & Abdulai, 2019).

Starchy root and tubers are energy giving food for human consumptions and the residues also serve as feed inputs for small ruminants and pigs. Cassava, yam, cocoyams constitutes the major root crops produced in Ghana. Root and tubers are not considered to be perishable crops. Yam and cocoyam, when harvested at maturity, can be stored for as long as 6-8months depending on the variety and quality. Farmers who want to capture high season prices may harvest their yams early while other farmers and traders may stockpile mature yams when prices are low. Wholesalers

are the typical buyers of yams from farmers (MEDA, 2011). Cassava is a staple food crop in Ghana but it is also important for the production of industrial starch and ethanol (Adjei-Nsiah & Sakyi-Dawson, 2012). When cassava roots are mature, harvesting can be staggered as required. They remain fresh so long as they are not harvested.

Tree nuts produced in Ghana include Cocoa and cashew. Sun drying of tree nuts after harvesting enhances their durability and storage capacity hence they do not easily perish. Cocoa is one crop that is produced for its export value. The buying and selling of it are controlled by Ghana's cocoa marketing board, COCOBOD. In selling cocoa to the international market, the cocoa marketing company a subdivision of COCOBOD has the sole right to sell. However, when it comes to internal buying and selling, although COCOBOD has the produce buying company, it gives licenses to several other companies to buy from farmers thus creating some competition. Some of these licensed buyers include Kuapa Kokoo, Armajaro, Olam, and Akuafo Adamfo (Laven et al., 2017). Cashew is also growing in importance for exports. Cashew is bought from farmers by exporters and cashew processing companies. As of 2009, there were about 12 of such processors however the majority of cashew are exported compared to local processing (GIZ, 2010)

Most vegetables in Ghana include tomato, onions, okra, eggplant, carrots, cabbage, and peppers. Such crops are highly perishable because of their high moisture content. The same can be said about fruit crops which include mango, pineapple, papaya, oranges, watermelon, passion fruit, and cantaloupe. Large vegetable markets are dominated by several wholesalers and retailers who are also controlled by "market queens". Farmers sell to traders at the farm gate, however, they may also bring the crops to the market to sell (Asselt, Masias, & Kolavalli, 2018). The fruit market is dominated by agro-processors, fresh exporters, wholesalers and traders who buy from farmers.

2.3. Inter-organizational relationships in the agri-food sector

The literature on inter-organizational relationships is enormous but in the field of the Business and Economics of Food and Agriculture, they are relatively scanty. For example a search on the Scopus, the most popular database, using the keywords “interorganizational relationships yields 2406 articles of which only about 1% covers subjects on agriculture. Two notable works summarized the research on relationships in the agri-food sector in the 1990s (G Galizzi & Venturini, 1999) and the 2000s (Fisher & Hartmann, 2010) in the USA, UK, Europe, Australia, Philipines, and China.

The first is the work by Venturini & Galizzi (1999) on “vertical relationships and coordination in the food system”. This work contains thirty-six papers that examine the economics of vertical relationships and coordination, contractual relationships and mechanisms of coordination and some case studies. A review of these papers shows that in developed countries, the food system’s pattern of operation which traditionally relied on the spot market was gravitating towards vertical relationships and coordination. This was the spur for research on vertical relationship topics. Regarding the rationale for firms opting for such relationships, one of the papers was an empirical study conducted in Germany at the time of the reduction of price guarantees for agricultural commodities in the political economy. It showed that securing future sales was the most important motive for farmers to sign long-term contracts (Drescher & Maurer, 1999). Other studies which have examined the rational of relationships in the agri-food sector pertains to the livestock industry (de Graaff & de Vlieger, 1999; J E Hobbs, 1995). Generally, it was clear that exploring the rationale underlying these relationships empirically for more diverse situations are needed.

The second notable work was by Fisher & Hartmann (2010) on “Agri-food chain

relationships". It contains seventeen papers on theoretical foundations, empirical evidence, and implications and outlook. The gravitation of the agri-food market in advanced countries towards more coordinated relationships is even more true in this recent work. One of the studies conducted in Ireland showed that about one in seven cattle farmers sold their finished cattle in the spot market while the remaining used some relationship with their main buyer (Henchion & McIntyre, 2010). The main focus of the papers, however, was to assess the sustainability of inter-organizational relationships. The lessons from this work indicated that the cases where buyers and sellers should lean on the spot market or rather using some specific typology of the inter-organizational relationship remain unclear in the literature (Chaddad, Fischer, & Hartmann, 2010).

In Ghana and Africa at large, most of the work that has been done on inter-organizational relationships pertains to the governance referred to as contract farming (Abdul-Rahaman & Abdulai, 2019; Bijman, 2008; Deb & Suri, 2013; Dubbert, 2019; Grosh, 1994; Kanburi Bidzakin, Fialor, Awunyo-Vitor, & Yahaya, 2019; Lambrecht & Ragasa, 2018; Oya, 2012; Poku, Birner, & Gupta, 2018; Porter & Phillips-Howard, 1997). The most prolific of such studies in Ghana include those that assess the formal (written) and informal (verbal) contracts (Abdul-Rahaman & Abdulai, 2019; Poku et al., 2018). Other typologies of farmers' relationships that pertain to how relationships are developed and the focus of such relationships need to be studied.

In the empirical research of the economic rationale for such contractual relationships, farmers' characteristics such as farm income, household income, age, gender, farming experience, education, and farm size have been explored. In that regard, a study conducted in Ghana on the factors influencing cassava farmers' participation in out-grower schemes found that farmers' characteristics were not significant in explaining the farmers' participation. They also found that the contract conditions such as whether it was formal or informal, the pricing arrangement, and

transportation significantly influence farmers' participation (Poku et al., 2018). Other Ghanaian studies also found only the age was significant in determining 458 rice farmers' participation decisions in contractual relationships (Abdul-Rahaman & Abdulai, 2019). However, there exist some contrary results in other countries that show that age, gender, farming experience, landholding, and organization membership are important in the farmers' decision to participate in contract farming (Bellemare, 2012). These results were based on an evaluation of 1200 farmers producing 10 different crops in Madagascar. The foregoing indicates that it is not fully clear in the literature how farmers' characteristics influence their contractual choice decisions.

According to the various contributions of the literature, product characteristics is also an important factor affecting the relationships farmers use and also their performance (Camanzi, Arba, Rota, Zanasi, & Malorgio, 2018; Fisher, 1997; Lajili, Barry, & Sonka, 1995). In this regard, Lajili et al. (1995) evaluate the factors influencing vertical coordination decisions where perishability one of the main characteristics of agricultural products was introduced as an indicator of the presence of transaction costs in spot markets in the agri-food sector. A further interesting contribution to the product as a factor was provided by Fisher (1997). He suggests that an effective supply chain strategy is based on considerations for the nature of the demand for products; the product lifecycle; demand predictability; product variety; and market standards.

Other studies provide a hint that there are tradeoffs between the spot market and inter-organizational relationships. For example, Lajili, Barry, and Sonka (1995) in their work based on synthesized literature identified spot markets to have disadvantages such as quantity and quality uncertainties, volatility in prices, information asymmetry, inefficiencies in cases of perishable products. These could be offset by building relationships. They also identified the advantages of spot markets to include little to no switching costs, reduced bargaining cost, and also sellers are

the sole claimants of residuals. The opposite was found true in built up relationships. Another example is Fisher and Hartmann (2010) who assert that the effectiveness of inter-organizational relationships over the competition in the market is dependent on the situation. The dependency on the situation is also supported by Oliveira and Lumineau (2019) whose work shows that the nature of transactions can affect the outcome of inter-organizational relationships.

2.4. Assessment of inter-organizational relationships in the agri-food sector

The study of inter-organizational relationships begins with situating it in a theoretical framework in the endeavor to bring an understanding of the factors that are important for their existence as well as their outcomes. Agency theory (Utomo, Onggo, & Eldridge, 2018), contingency theories and exchange theories (Maypole, 1982), stakeholder, learning and strategic choice theory (Barringer & Harrison, 2000) have been used to understand inter-organizational relationships. Some of the earlier theories include those of Van De Ven (1976) who developed a theory referred to as the "social action system" which is also traceable to the system theorists Parsons (1960) and Von Bertalanffy (1972). However, more prominent among the theories stand the transaction costs theory and resource-based theory. Chaddad and Rodriguez-Alcalá (2010), in their work on inter-organizational relationships in the agri-food system, perceived that the resource-based view explains the horizontal relationships and relationships between organizations from different industries while vertical relationships are dominated by the transaction cost theory. Cropper, Ebers, Huxham, & Ring (2008), provides some review of the origins and chronology of the theories for understanding inter-organizational relationships.

Empirical research in inter-organizational relationships in the agri-food sector has not kept pace with the theoretical contributions due to the difficulty in measuring constructs (Galizzi &

Venturini, 1999; Kataike & Gellynck, 2018; Oya, 2012). In the estimation of the economic rationale and outcomes of inter-organizational relationships, some approaches that have been used include the Tobit model. This is used when the dependent variable is censored. Probit and logit models have also be used in other empirical studies that try to explain farmers' participation decisions. In such cases, participation has been modeled as a binary choice variable (Poku et al., 2018; Xaba & Masuku, 2012). Others have used multinomial logit where the farmers' choice was between more than two methods for selling their outputs (Abdul-Rahaman & Abdulai, 2019; Boger, 2001). One issue that pertains to empirical modeling is the measurements of transaction costs when they are included. Some have used a ranking based on a Likert scale with some conjoint analysis, Hobbs (1995), or factor analysis, Camanzi et al. (2018) or principal component analysis, Masakure and Henson (2005). Others have also used a monetary measure based on the observed choice of the market (Vakis, Sadoulet, & Janvry, 2003).

The most commonly used measures of performance in the context of the relationships that farmers engage to sell their output include farm income, household income, the proportion of the sale, the average price (Abdul-Rahaman & Abdulai, 2019; Alemu, Maertens, Deckers, Bauer, & Mathijs, 2016; Camanzi et al., 2018; Hobbs, 1995). Generally, there is a lack of consensus in measuring the performance of inter-organizational relationships because of the complexity and challenge of being able to link it to the relationship (Provan & Sydow, 2009). This could be compounded by the positivist tradition of seeking objectivity and precision in such evaluations (Colander, 1992). Provan and Sydow (2009) also perceived that the different theoretical perspectives used in understanding inter-organizational relationships is a contributor. However, their work which was to present a rationale for the evaluation of inter-organizational relationships was based on an assumption that inter-organizational relationships “are the product of purposeful

choices by organizational managers, even if these choices are motivated in part by pressures to conform". The purposefulness of the choice is a fundamental construct of human action theory (Von Mises, 1966), though this was not recognized in their work. The human action theory has hardly ever been used in the study of inter-organizational relationships. This research attempts to enhance understanding and evaluation of these relationships using human action economics concepts and transaction cost theories.

2.5. Contribution to the literature

Given the foregoing gaps in the literature, the primary contribution of this research was to provide the rationale for farmers' participation in inter-organizational relationships in Ghana and expand the evaluation of outcomes beyond the governance of relationships.

The existing literature on inter-organizational relationships in the agri-food sector is particularly scanty relative to other fields. The development in the literature from the 1990s suggested that most needed was the understanding for farmers opting for such relationships as well as the cases in which buyers and sellers should lean on the spot market or some type of relationship. The Ghanaian studies on inter-organizational relationships have covered mainly the governance, contract farming (informal and formal agreements). Although assessing the governance of farmers' relationships is meaningful, they may not capture the full picture that will provide insights for policies to support farmers' achieve their economic objectives.

This study, therefore, attempted to illuminate farmers' motivation for participating in inter-organizational relationships and to evaluate other typologies of relationships beyond the governance. The understanding was based on the transaction cost and human action theories.

Chapter 3 Methods

3.1. Background

This research attempted to provide an understanding of the factors' motivating farmers to participate in inter-organizational relationships are well as the hierarchy of such relationships in terms of incremental revenue. Given that the research objective is situated within the frame of transaction cost and human action theories, a mixed-method was an attractive approach because of the associated non-pecuniary components. The mixed-method involved collecting and analyzing both qualitative and quantitative data hence providing the basis for a complete study of the motivators for the farmers' participation in relationships with their downstream partners.

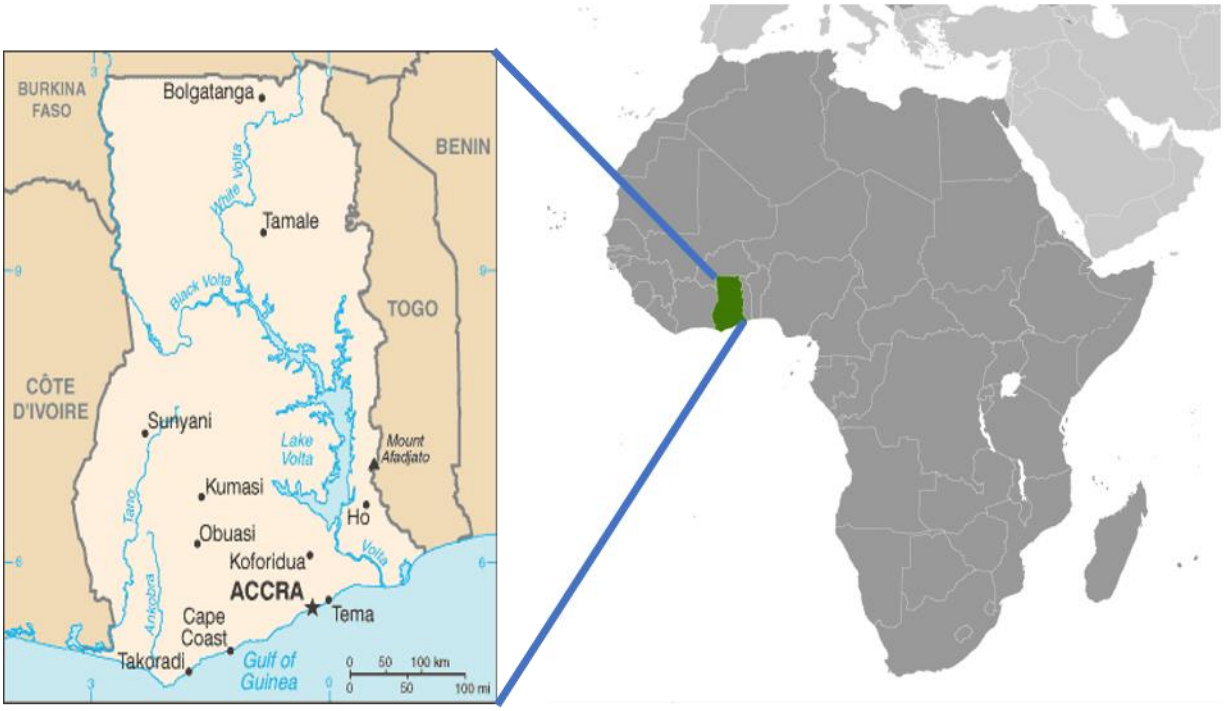
The literature, however, shows a diversity of approaches that have been used in the context of inter-organizational relations: qualitative methods (Mighell & Jones, 1963); quantitative (Frank, 1992; Levy, 1985); and mixed methods (Hobbs, 1995). Both quantitative and qualitative have weaknesses that can be offset by using a combination of the two. Quantitative methods tend to hide the context of the research while the qualitative methods may be subjective and cannot be generalized. The superiority of the mixed methods is because it allows both exploration and analysis simultaneously.

The mixed-methods approach was, therefore, followed to collect primary data from farmers for this research. The triangulation design, the most common approach to mixing methods, Creswell (2014), was of interest here as it allows the confirmation of the factors and motivators for farmers' participation in relationships while controlling for farmer characteristics. The study area, survey sampling, data, data collection process, and methods are discussed in this section.

3.2. Study area

Ghana is a tropical country located in West Africa. It is bordered by Burkina Faso to the north, the Ivory Coast to the west, Togo to the east and the Gulf of Guinea and the Atlantic Ocean to the south. The coastline is about 550km long (MoFA, 2011). As of 2018, the country's population was estimated to be 29million with about 56.7% being urban population (World Bank Group, 2019). The climate is a gradient of wet to dry from the south to the north. The country is therefore classified into four agro-ecological zones: rain forest, deciduous forest, transitional zone, and northern savanna. Agriculture employs about half of the population and contributes 20% of GDP (World Bank Group, 2019). Crop production is the dominant sub-sector in agriculture and the principal crops produced include, cocoa, cassava, yam, maize, millet, rice, papaya, mango, tomatoes, and cashew (MoFA, 2011).

Figure 3.1: Study Location – Ghana – Within the Context of Africa



Source: (Central Intelligence Agency, 2019)

3.3. Survey Sampling

The questionnaire was tested on a pilot sample of a dozen farmers in Ghana. The snowball sampling technique was used to sample and collect data from 354 farmers in Ghana. The snowballing was initiated with a base list of 110 farmers provided by two agro-processing firms who buy farm products from these farmers. Approximately 90 farmers out of the base list were interviewed. Each farmer interviewed was asked to supply the names and contacts of any other farmer(s) they knew. These new set of farmers were also interviewed and asked to supply names and contacts of other farmers. This process constituted the snowballing approach that was used. The process was ended when the farmers being added to the list dwindled and lingered at the sample size of 354 farmers.

3.4. Data

The data provides comprehensive information on farmers regarding the research subject. A structured questionnaire was used to collect primary data from farmers in Ghana. The questions were structured as farmers' enterprise profile; participation separation; production options; motivating factors, and demographics of farmers.

Farmers' enterprise profile covered the crops the farmers produce for sale. 37 crops, most of which are the main crops produced in Ghana were presented in the questionnaire for farmers to select (MoFA, 2016). These crops were fruits, grains, legumes & oilseeds, root crops, tree nuts, and vegetables. The enterprise profile also covered the acreages allocated to farmers' selected crops.

Participation separation question was posed to classify farmers as participants or non-participants in inter-organizational relationships. The general question posed was, “Do you

currently participate in any formal relationship with any buyer?" which required a dichotomous answer of yes or no. The formal relationship was defined here as those that involved a written agreement or agreement in principle to perform specific tasks in exchange for specific benefits that were known before sale transactions occurred. Further questions were presented under the production options to characterize the relationships that farmers belonged. These questions included relationship-specific investments and the information regarding crop quantity, quality and price that farmers received from buyers before the sale. Quantitative data were solicited under this group with questions about price premium, and proportions of products sold or spoilt. The questions were asked respectively as follows, "Suppose the market price is GHS 1.00, how many more pesewas do you typically receive when you sell your produce?" and "Suppose you produced 100units of each of your selected crops, indicate the proportion of each that you were able to sell in the last season?".

Farmers motivating factors covered the various transactions cost-reducing factors. These included questions on price-related factors, quantity-related factors, information-related factors, and service-related factors.

Demographics of farmers included questions for the farmers' farm and off-farm income, age, farming experience, formal education, and gender.

3.5. Data collection

The data was collected over one month (August 2019) by telephone survey. The telephone interview has also been used to collect from farmers in Ireland where face-to-face interviews were not possible (Henchion & McIntyre, 2010). In 2018, the mobile cellular subscription was about 138 per 100 people in Ghana (World Bank, 2019). This showed that generally, every farmer owned

a mobile phone in Ghana. The telephone survey was a feasible method because telecommunication networks in Ghana did not have any charges for receiving calls at the time the data was collected. The data that was needed from the farmers did not require any physical verifications and so a telephone survey was as good as a face-to-face survey. The telephone survey used in place of face-to-face surveys reduced the survey cost by about 60%.

Five enumerators were trained for two days and used in the data collection process. The base list of 110 farmers was distributed among the enumerators to begin the telephone survey. Each farmer was called on their mobile phones, the source of their contacts, purpose, and duration of the survey was explained to them. They were then asked if they could take part in the survey and if so, arrange a suitable interview date and time. This process ensured respect for the farmers' time and farmers were more willing to share information when they fixed their interview times. The times recorded for the interviews showed that farmers scheduled their interviews at different times during the day from as early as 7 am to as late as 8 pm. After every interview, the farmers were asked to supply the names and contacts of other farmers. This allowed us to increase the base list of farmers.

The challenge of the telephone survey laid in the cases when farmers' contacts could not be reached (network issues), farmers did not answer their phones, farmers call disconnected mid-way of an interview and when a farmer’s contact provided by another farmer was incorrect. These cases required high effort from the enumerators. The enumerators worked independently and were managed remotely. Communication was through telephone calls, emails and WhatsApp messaging and they were paid using mobile money. The two-day training was the only physical meeting. To motivate the enumerators to put in the high effort, ensure data quality and prevent any moral hazard tendencies, certain strategies were put in place.

The first strategy was the type and number of enumerators recruited. The enumerators' level of education was from BSc to MSc and they also had 2 to 6 years of experience in enumeration. Two more enumerators were recruited than was needed to have a buffer supposing any enumerator dropped out or any had to be dismissed for any reason. The second strategy was the remuneration and logistics for the enumerators. The enumerators were paid 10% higher than the maximum wage in the market wage range for enumerators. Each of the enumerators was provided a data capturing device (tablet), a registered sim card and airtime but they had to use their mobile phones to carry out the telephone interviews. The last strategy was the monitoring and punishment systems put in place for the enumerators. The enumerators were managed individually rather than as a group to enhance responsiveness and accountability. Each enumerator after completing 12 interviews, uploaded the data and submitted a report of the names of the 12 farmers, their mobile numbers, the start time of the interview and any comments. The data were cross-checked for anything missing and some of the farmers were randomly called to ascertain the information recorded by the enumerators. The registered sim cards allowed the request for a Sim card usage report from the network provider to track and confirm the call activities of enumerators. The enumerator was paid when data uploaded was satisfactory, however consecutive inconsistencies or missing data could result in dismissal and non-payment. None of the enumerators recruited was dismissed however one of the enumerators had a non-payment for two interviews which had missing data.

The data collection process ensured the anonymity and confidentiality of farmers' data by separating the names of the farmers from the data. The report the enumerators submitted had the names of the farmers and the time each interview was started however the uploaded data did not

have any names but captured the interview start and end times for each farmer. The interview start time, therefore, served as the identifier of the farmer interviewed.

3.6. Theoretical framework

Two notable theories form the foundation for analyzing the farmers' motivation for participating in inter-organizational relationships: The transaction cost theory first conceptualized by Ronald Coase (1937) in his seminal paper, " the nature of firms" and later given a name and bounds by Williamson (1975; 1985); and the human action economics (Von Mises, 1966).

Coase began describing transaction costs by recognizing that regardless that economic theory promises efficiencies with the market, much economic activity also exists within integrated firms. He ascribed the reasoning that, for this to happen, there must be inefficiencies (costs) present in the market which economic agents can get rid of by using the integrated firm. This recognition set the stage for the concept of the transaction cost.

Williamson summarized his seminal work on transactions cost economics in the book, "the economic institutions of capitalism". He defined transaction costs as, "the cost of running the economic system" (from Arrow (1969)). Transactions costs "are to be distinguished from production costs, which is the cost category with which neoclassical analysis has been preoccupied" (Williamson, 1985a). Williamson identified transaction costs to exist both ex-ante and ex-post transactions. He assumed that in transactions, the human agent has bounded rationality hence their rational intentions have limitations. They are also given to opportunism in the presence of uncertainty. An essential element in his description of transaction cost is asset specificity, which is the investment parties would not make were it not for the specific transaction. An untimely termination of asset-specific transactions could sacrifice productive value or incur additional costs.

Based on these assumptions Williamson defined transaction costs to include search costs, time and expense of negotiating, writing and enforcing contracts; the cost of opportunistic behavior such as ex-post renegotiations cost (hold-ups); and the cost of preventing such opportunistic behaviors.

The second theory recruited to analyze farmers' motivation for participating in inter-organizational relationships, is the human action economics by von Mises (1966) presented in his famous book, "Human action, a treatise on economics". He asserts that human action is a conscious or purposeful behavior and necessarily always rational. This is distinguishable from the neoclassical economic theory which assumes that economic actors have specific goals such as utility maximization or profit maximation and they are also substantively rational (Mahoney, 2005). Von Mises explains that human action is always aimed at satisfying the desire of the acting man. Satisfaction is based on the individual's value which is "different for various people and for the same people at various times". Three conditions form the basis for an individual's decision to act: state of apprehension, determined by the individual; the conception of an improved state; and the expectation that the purposeful action will improve his apprehensive state. Therefore, by human action economics, an individual's action is always right.

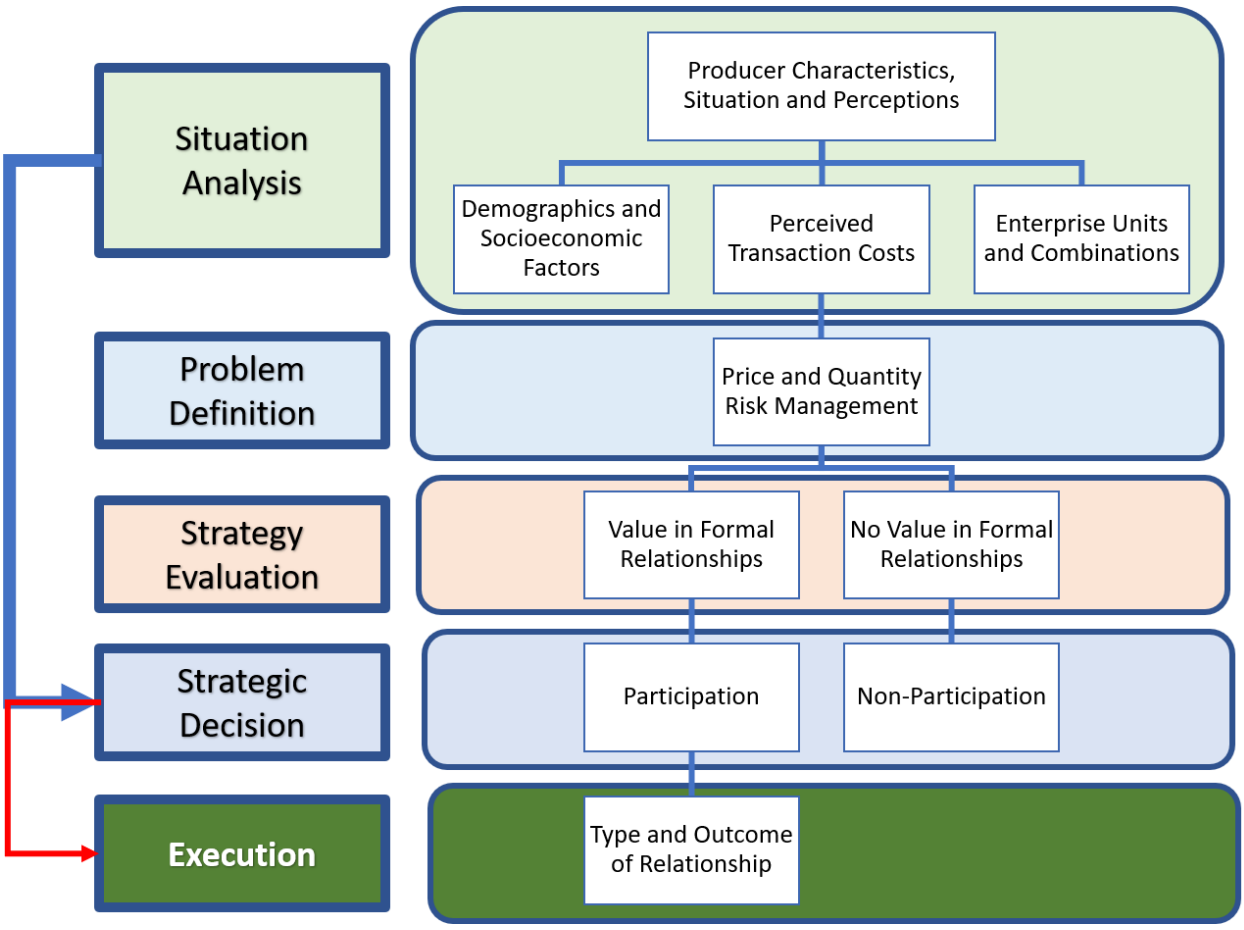
3.7. Conceptual framework

This research is focused on understanding the farmers' motivation for participating in inter-organizational relationships. As discussed earlier the farmer has the option of selling their products in the spot market or selling to buyers with whom they have a formal relationship. We argued that transaction costs, coupled with farmers' socioeconomic and crop enterprises may be at play in shaping farmers' choice of how to sell their products. A farmers' decision to participate in a relationship with a buyer, from human action economics, is initiated by the realization of an

apprehensive state (Von Mises, 1966). Following this realization, the farmer should be able to conceive one or more possible solutions that could improve his situation. Finally, the farmer should expect that his preferred state would be achieved when he carries out the planned solution.

Consider, for example, a farmer realizes that he is faced with unpredictable revenues and the inability to plan the production of his crops because of price variability and deterioration or spoilage of products from delayed sales in the spot market. Suppose he is uneasy about this realization and decides to do something about it. Figure 3.2 illustrates the motivating factors and the farmers' decision-making process.

Figure 3.2: Conceptual Framework for Farmers' Decision to Participate in Relationships



The problem identified by the farmer originates from transaction cost which includes the time and effort expended in searching for the buyer. Opportunistic behaviors of buyers and the

cost of preventing such behavior are also transaction costs forming the farmers' problem origin. For example, the farmer may have to transport his farm products over a considerable distance to other markets for the possibility of higher prices. Buyers may however offer lower prices depending on the crop characteristics and how much information they have about the farmers' alternatives. If the farmer tries to prevent such opportunistic behaviors by selling locally, he forfeits the possibility for higher prices in other markets. The result of these transaction costs coupled with the farmers' crop and socioeconomic characteristics is the prevalence of price and sales variability.

When the farmer is faced with prices and sales variability, he may be apprehensive or not. Suppose the farmer is apprehensive because he realizes a problem of unpredictable revenues and inability to plan production, he would choose to participate in a formal relationship with a buyer. This is with the expectation that he would have predictable revenues and be able to plan production. Choosing to participate directs the farmer towards deciding on how to develop the relationship with the buyer. That is whether directly with the buyer, through the farmer-based organization or an agent. ; The farmer may also decide what specification to focus on in the relationship (either price, quantity, quality-focused or a combination of any of the three); and governance of the relationship.

Suppose instead that individual farmers are not apprehensive about the market risks (prices and quantity sold) confronting them, then they will be less inclined to participate in any formal relationships because these relationships, it has been noted, are not "free", but do have inherent transaction costs. Additionally, the nature of their enterprise units may make these costs higher in formal relationships than in atomistic market exchanges.

3.8. Data analysis

The study was designed with three specific objectives, to identify the typologies of relationships that exist among participating farmers; to understand the motivating factors for the farmers' decision to participate in formal relationships; to estimate the hierarchy of the different typologies of relationships that farmers use in terms of incremental revenue.

3.8.1. To identify the typology of farmers relationships

The typology in terms of the way farmers develop their relationships with buyers, the focus of the relationship and means by which these relationships are governed were identified by asking the farmers three (3) specific questions. One of the questions posed was “Please indicate which method you used to develop your most profitable relationship for each of crops”, and the options were, direct to the buyer, through farmer-based associations and an agent. The second question posed was “Please indicate which of the following focus areas apply to each of the relationships you have with buyers of each of your selected crops” with the options given as focused on quantity, quality, price, or their combinations. The final question asked was “which is the most common governance mechanism used in your relationships”? Eleven (11) options such as verbal agreements, written agreement, certifications, delivery bonding, and written contracts were provided to farmers. These were later classified as formal and informal agreements.

The data retrieved from farmers’ responses were analyzed using frequencies and percentages to show which farmers and how many farmers belong to the various typologies of inter-organizational relationships.

3.8.2. To understand the factors motivating farmers' participation decision

To understand the farmers' participation decision, we used the binary logit regression. The farmers' decision was treated as a binary choice variable, P_i , with participation as the outcome of interest. The question posed to the farmer is: "Do you currently participate in any formal relationships with any buyer?" Farmers' responses were coded as one (1) if "yes" and zero (0) if "no". Hence the probability, π_i, that a farmer chooses to participate is defined as a function of a vector of explanatory variables, X_i, encompassing farmers' socioeconomic and demographic characteristics, crop enterprises and associated transactions costs (Table 3.1) with coefficient estimates, β, given as:

$$\boldsymbol{\pi_i = Prob(P_i = 1) = F(X_i'\beta) = \frac{e^{X_i'\beta}}{1 + e^{X_i'\beta}}} \quad \textbf{(3.1)}$$

The underlying assumptions of the binary logit regression are the standard logistic distribution and the existence of an unobservable latent response variable, $\boldsymbol{P_i^*}$. This latent response variable is a continuous random variable that can be any value in the real line. This assumption presupposes that the farmers' decision to participate in formal relationships or not, $\boldsymbol{P_i}$, is a manifest response which occurs if and only if $\boldsymbol{P_i^*}$ exceeds a certain threshold. To identify the model, we standardize $\boldsymbol{P_i^*}$ to have a threshold of zero and a standard deviation of one.

Given that the outcome of interest occurs when $\boldsymbol{P_i^*}$ exceeds zero, we can write the probability, $\boldsymbol{\pi_i}$, that a farmer chooses to participate as:

$$\boldsymbol{\pi_i = Prob(P_i = 1) = Prob(\ P_i^* > 0)} \quad \textbf{(3.2)}$$

Suppose now that the farmers' participation depends on $\boldsymbol{X_i}$, we model the latent variable as:

$$\boldsymbol{P_i^* = X_i'\beta + U_i} \quad \textbf{(3.3)}$$

where $\boldsymbol{U_i}$, is a vector of systematic random error terms assumed to have the standard logistic distribution with a cumulative distribution function F(u). $\boldsymbol{\beta}$ is the vector of coefficients of $\boldsymbol{X_i}$, which constitutes 7 farmers' characteristics, $\boldsymbol{X_i(7)}$**;** 5 crop enterprises, $\boldsymbol{X_i(5)}$**;** and 17 transactions cost variables, $\boldsymbol{X_i(17)}$; represented as:

$$\boldsymbol{X_i'\beta} = \{\boldsymbol{X_i'(7)};\ \boldsymbol{X_i'(5)};\ \boldsymbol{X_i'(17)}\}\boldsymbol{\beta} \quad \textbf{(3.4)}$$

Under this model, the probability, $\boldsymbol{\pi_i}$, that the farmer chooses to participate is given as:

$$\boldsymbol{\pi_i} = \boldsymbol{Prob}(\boldsymbol{P_i} = \mathbf{1}|\boldsymbol{X_i}) = \boldsymbol{Prob}(\boldsymbol{P_i} > \mathbf{0}) \quad \textbf{(3.5)}$$

$$\boldsymbol{\pi_i} = \boldsymbol{Prob}(\boldsymbol{P_i} = \mathbf{1}|\boldsymbol{X_i}) = \boldsymbol{Prob}(\boldsymbol{U_i} > -\boldsymbol{X_i'\beta}) \quad \textbf{(3.6)}$$

$$\boldsymbol{\pi_i} = \mathbf{1} - \boldsymbol{F}(-\boldsymbol{X_i'\beta}) \quad \textbf{(3.7)}$$

To estimate the relationship in equation **(3.1)**, we use a likelihood function **L** defined as:

$$\boldsymbol{L} = \boldsymbol{\Pi_{Y_i=0}} \boldsymbol{F}(-\boldsymbol{X_i'\beta}) \boldsymbol{\Pi_{Y_i=1}} \{\mathbf{1} - \boldsymbol{F}(-\boldsymbol{X_i'\beta})\} \quad \textbf{(3.8)}$$

We can then estimate the closed-form expression in equation **(3.1)** as follows:

$$\boldsymbol{\pi_i} = \boldsymbol{Prob}(\boldsymbol{P_i} = \mathbf{1}) = \boldsymbol{F}(\boldsymbol{X_i'\beta}) = \frac{\boldsymbol{e^{X_i'\beta}}}{\mathbf{1} + \boldsymbol{e^{X_i'\beta}}}$$

This probability can be expressed in terms of odds ratio which is the probability of the farmer choosing to participate, $\boldsymbol{P_i} = \mathbf{1}$**,** relative to the probability of choosing not to participate, $\boldsymbol{P_i} = \mathbf{0}$. The odds ratio is given as:

$$\frac{\boldsymbol{P}}{\mathbf{1} - \boldsymbol{P}} = \boldsymbol{e^{X_i'\beta}} \quad \textbf{(3.9)}$$

Table 3.1: Variables for the binary logit model

Categories of variables	Variables	Type of variable
Dependent Independent	Participation	Binary (Yes/No)
Farmers' Characteristics	Age, education, farming experience, farm & off-farm income, Gender, full-time farmer,	Continuous Binary (Yes/No)
Transactions cost	Assured price (1); Price premium (2); Knowing price ahead of sale (3); Opportunity to improve price when market conditions change (4); Decreased price variability during the season (5); Guaranteed sale (6); Avoidance of spoilage resulting from of delay in sales (7); Matching production to planned sale (8); Reduction in overproduction (9); Opportunity to sell all production (10); Knowing buyers' desired product specifications ahead of production (11); Knowing the quantity the buyer needed from me (12); Knowing the quality the buyer expected from me (13); Knowing the delivery times for my product (14); Knowing the delivery location for my products (15); Better communication with buyer allows me to better plan (16); On-time payment by partner (17)	Categorical Extremely likely (1); Somewhat likely (2); Neither likely nor unlikely (3); Somewhat unlikely (4); Extremely unlikely (5)
Crop Enterprise	Fruits (1); Grains (2); Roots (3); Tree nuts (4) and Vegetables (5)	Binary (Yes/No)

The farmers who participate in relationships were asked the following question about the transaction cost variables, "To what extent did the following factors motivate you to participate in a formal buyer relationship?". The non-participating farmers were asked the following question, "what is the likelihood that the following factors would motivate you to participate in a formal buyer relationship?". The responses were given on a scale of 1 (extremely likely) to 5 (extremely unlikely). The principal component analysis (PCA) was used to derive a succinct number of variables, principal components, from the 17 transaction cost variables that capture the main information given by these variances and correlations or covariances (Jolliffe, 2002).

The principal components are specific linear combinations of the 17 random variables $\boldsymbol{X_1, X_2, \ldots, X_{17}}$ which depends only on the covariance matrix, $\sum$. Let the random vector, $\boldsymbol{X' = [X_1, X_2, \ldots, X_{17}]}$ have the covariance matrix, $\sum$, with eigenvalues $\boldsymbol{\varepsilon_1 \geq \varepsilon_2 \geq \ldots \geq \varepsilon_{17} \geq 0}$. Consider the linear combinations

$$\begin{aligned} \boldsymbol{Y_1} &= \boldsymbol{\ell_1' X = \ell_{11} X_1 + \ell_{21} X_2 + \ldots + \ell_{171} X_{17}} \\ \boldsymbol{Y_2} &= \boldsymbol{\ell_2' X = \ell_{12} X_1 + \ell_{22} X_2 + \ldots + \ell_{172} X_{17}} \\ &\vdots \qquad\qquad\qquad\qquad \vdots \\ \boldsymbol{Y_{17}} &= \boldsymbol{\ell_{17}' X = \ell_{117} X_1 + \ell_{217} X_2 + \ldots + \ell_{1717} X_{17}} \end{aligned} \tag{3.10}$$

Then,

$$\boldsymbol{Var(Y_i) = \ell_i' \sum \ell_i \qquad i = 1, 2, \ldots, 17} \tag{3.11}$$

$$\boldsymbol{Cov(Y_i, Y_k) = \ell_i' \sum \ell_k \qquad i, k = 1, 2, \ldots, 17} \tag{3.12}$$

The principal components are the uncorrelated linear combinations $\boldsymbol{Y_1, Y_2, \ldots, Y_{17}}$ whose variances in equation **(3.11)** are as large as possible. To obtain $\boldsymbol{m}$ number of principal components with the largest variances and have more stable estimates, the maximum eigenvalue for inclusion was set to unity (Jolliffe, 2002).

The principal components were used in the binary logit regression in place of 17 variables themselves. Principal components are uncorrelated and hence multicollinearity issues are avoided. The value (score) of the principal components for each observation is given by:

$$\boldsymbol{Z = XA} \tag{3.13}$$

where the **(*i, k*)th** element of **Z** is the value (score) of the ***k*th** principal component for the ***i*th** observation, **X** here is an (n x 17) matrix and **A** is a (17x17) orthogonal matrix whose ***k*th** column is the ***k*th** eigenvector of $\boldsymbol{X'X}$ (assumed to be proportional to the correlation matrix of the 17 variables). Since A is orthogonal, $\boldsymbol{X_i'(17)\beta}$ in equation **(3.4)** can be rewritten as:

$$\boldsymbol{X_i'(17)AA'\beta = Z_i'(m)}\gamma \tag{3.14}$$

where $\gamma = \boldsymbol{A'\beta}$ and **m < 17**. Equation **(3.4)** can, therefore, be rewritten as:

$$\boldsymbol{X_i'\beta = \{X_i'(7);\ X_i'(5);\ Z_i'(m)A'\}\beta} \tag{3.15}$$

The empirical specification of the binary logit model of the probability of farmers choosing to participate (P=1) is given as:

$$Prob(P_i = 1) = \alpha_0 + \beta X_i'(7) + \beta X_i'(5) + \gamma Z_i'(m) \tag{3.16}$$

$$\begin{aligned} Prob(P = 1) = {} & \alpha_0 + \beta_1 Age + \beta_2 Educ + \beta_3 Fminc + \beta_4 Offinc + \beta_5 Gen \\ & + \beta_6 Occ + \beta_7 Fmexp + \beta_8 Frt + \beta_9 Grn + \beta_{10} Rt + \beta_{11} Nt \\ & + \beta_{12} Veg + \gamma_i PC^m + e \end{aligned} \tag{3.17}$$

Where *Age, Educ, Fminc, Offinc, Gen, Occ and Fmexp* represents the farmers' age, educational level, farm income, off-farm income, Occupation – full-timer/part-timer, and farming experience. The farmers' crop enterprises are represented by *Frt, Grn, Rt, Nt, and Veg* which indicates fruits, grains, roots, tree nuts, and vegetables. PC^m represents *m* number of principal components and the regression error term is defined by *e*. STATA/IC 14.2 was used to determine the estimates of the

covariates. The dependent variable in equation **(3.17)** defines the farmers who participate as *P=1*, and those who do not participate as *P=0*.

The multinomial logit regression was used to determine how far the farmers' choice of the method of developing their relationship was predicted by the same covariates in the binary logit model. The methods farmers used to develop their relationships are treated as the categorical variable, $\boldsymbol{Y_i}$, with the alternatives (1) "direct to the buyer" (2) "farmer-based organizations" (FBOs) and (3) "other methods". Let $Prob(Y_i = \text{j})$, be the probabilities for each of the alternatives *j* for farmer *i*. Then (Cameron & Trivedi, 2009)

$$\boldsymbol{P_{ij} = Prob(Y_i = j) = F_j(X_i'\beta) = F_j(X_i'\beta_1, X_i'\beta_2, X_i'\beta_3)} \quad \textbf{(3.18)}$$

Where $\boldsymbol{X_i'}$, denotes the value of the independent variables for farmer *i* (Table 3.1-with transactions cost variables replaced with principal components) and the parameters $\boldsymbol{\beta_j}$ differ across alternatives and $\boldsymbol{\beta = (\beta_1', \beta_2', \beta_3')'}$. The parameter identification requires a normalization such as $\boldsymbol{\beta_2 = 0}$ because $\sum_j \boldsymbol{P_{ij}} = 1$. The multinomial logit model can be specified as:

$$\boldsymbol{P_{ij} = \frac{e^{X_i'\beta_j}}{\sum_{k=1}^{3} e^{X_i'\beta_k}}}, \quad j = 1, 2, 3 \quad \textbf{(3.19)}$$

Similar to the binary logit model which compares the odds of choosing between two alternatives, in the multinomial logit models, the comparison is to a base category i.e. the alternative that has its coefficients normalized to zero ($\boldsymbol{\beta_2 = 0}$). The probability that a farmer chooses to develop a relationship using alternative *j* given that the outcome can be *j* or 2 is written as:

$$\boldsymbol{Prob(Y = j | Y = j \text{ or } 2) = \frac{P_j}{P_j + P_2} = \frac{e^{X_i'\beta_j}}{e^{X_i'\beta_j} + e^{X_i'2}} = \frac{e^{(X_i'\beta_j - X_i'\beta_2)}}{e^{(X_i'\beta_j - X_i'\beta_2)} + 1}} \quad \textbf{(3.20)}$$

$$\boldsymbol{= \frac{e^{(X_i'\beta_j)}}{1 + e^{(X_i'\beta_j)}}}$$

However, because $\boldsymbol{\beta_2 = 0}$, the relative risk of choosing alternative j relative to alternative 2 can be expressed as:

$$\frac{\mathbf{Prob(Y = j)}}{\mathbf{Prob(Y = 2)}} = \frac{\frac{\mathbf{e}^{(\mathbf{X_i'\beta_j})}}{\mathbf{1 + e}^{(\mathbf{X_i'\beta_j})}}}{\frac{\mathbf{1}}{\mathbf{1 + e}^{(\mathbf{X_i'\beta_j})}}} = \mathbf{e}^{(\mathbf{X_i'\beta_j})} \quad \textbf{(3.21)}$$

Hence $\boldsymbol{exp(\beta_r)}$ gives the proportionate change in the relative risk when the ***rth*** regressor in ***X*** for farmer ***i*** with alternative ***j*** changes by 1 unit.

3.8.3. To estimate the hierarchy of the various typologies of farmers relationships with buyers in terms of incremental revenue

The incremental revenue is defined here as the value of the farmers' sales which is based on the percentage of farm products sold and the percentage price premium. Suppose the farmer in a relationship sells a proportion of his products, $\boldsymbol{Q_i}$ at a proportion, $\boldsymbol{\pi_i}$ above the market price, $\boldsymbol{P}$, then the revenue from the relationship is given by

$$\boldsymbol{R_r = Q_i * P(1 + \pi_i)} \quad \textbf{(3.22)}$$

Suppose the farmer rather sells the same proportion of his products, $\boldsymbol{Q_i}$ in the spot market then the revenue from the spot market would be:

$$\boldsymbol{R_s = Q_i * P} \quad \textbf{(3.23)}$$

The incremental revenue is therefore given as:

$$\boldsymbol{R_r - R_s} = (Q_i * P) + (Q_i * P * \pi_i) - (Q_i * P) = \boldsymbol{Q_i * \pi_i} \quad \textbf{(3.24)}$$

Where the market price, ***P=1*** and $\boldsymbol{\pi_i}$, is the price premium, which was obtained by asking the farmer the following question, "Suppose the market price is GHS 1.00, how many more pesewas do you typically receive under your most profitable buyer relationships for each of your crops?".

$\boldsymbol{Q_i}$, is the quantity sold and was obtained by asking the farmer this question: "Suppose you produce 100 units of each of your selected products. Please indicate what proportion of your current production you sell through your most-profitable marketing relationships". This method of estimating revenue eliminates the complexities associated with using actual prices.

3.9. Research Hypothesis

The extent of transaction costs influences the choice of relationships. It is therefore hypothesized in this study that reducing transaction costs increases the likelihood of farmers participating in relationships with buyers. From equation **(3.17)** we can state:

$$\boldsymbol{H_0}: \gamma_{\boldsymbol{i}} = \boldsymbol{0}$$
$$\boldsymbol{H_1}: \gamma_{\boldsymbol{i}} > \boldsymbol{0} \qquad \textbf{(3.25)}$$

It is also hypothesized that farmers are likely to participate in relationships based on the perishability of the crop they produce. Fruits and vegetables are highly perishable and therefore fruit and vegetables farmers are more likely to participate in relationships. However, Grains are dry and less perishable hence grain farmers may be indifferent to participating in relationships. Tree nuts are usually dried by farmers before sale therefore the likelihood of tree nut farmers participating would be no different from farmers who do not produce tree nuts. Finally, root crops are not as perishable as fruits and vegetables, which requires timely harvesting to avoid deterioration. Harvesting of root crops can be staggered on a need basis. Therefore root crop farmers' participation in relationships would be no different from root crop farmers for that matter. From equation **(3.17)** we can state the hypotheses as:

$$\boldsymbol{H_0}: \boldsymbol{\beta_8 = 0; \beta_9 = 0;\ \beta_{10} = 0;\ \beta_{11} = 0;\ \beta_{12} = 0}$$
$$\boldsymbol{H_1}: \boldsymbol{\beta_8 > 0;\ \beta_i \neq 0;\ \beta_i \neq 0;\ \beta_i \neq 0;\ \beta_i > 0} \qquad \textbf{(3.26)}$$

Chapter 4 Results

4.1. Overview

This chapter presents findings that address the research objectives: (1) Identified typologies of inter-organizational relationships in which farmers participate to sell their farm products; (2) Estimates and comparison of the net benefits associated with the farmers' participation in inter-organizational relationships; and (3) the hierarchy of the typologies inter-organizational relationships in terms of incremental revenue. The results begin with the summary statistics of the farmers followed by the empirical analysis for each objective.

4.2. Descriptive Analysis

This study used primary data collected from farmers in Ghana in August 2019. This section provides the relevant summary statistics of the data. The results in Figure 4.1 show that the farmers produced the following categories of crops: grains, legumes, and oilseeds (shorted as grains); tree nuts; roots; vegetables; and fruits. The respective proportions of farmers producing these crop categories were 58%, 57%, 46%, 17%, and 16%. That the sum of these proportions exceeds 100 percent implies that some farmers selected multiple crop categories as crops they were producing (Table 4.1). The table shows that no more than 10% of farmers produced a single crop. Contrarily, as high as 32% of farmers produced grains and tree nuts, while 25% produced root crops and tree nuts. This is not surprising since tree nuts are essentially produced for their commercial value, while grains and root crops often have dual uses, serving commercial objectives as well as household food supply objectives.

Figure 4.1: Proportion of Farmers Producing Various Crop Categories (N=354)

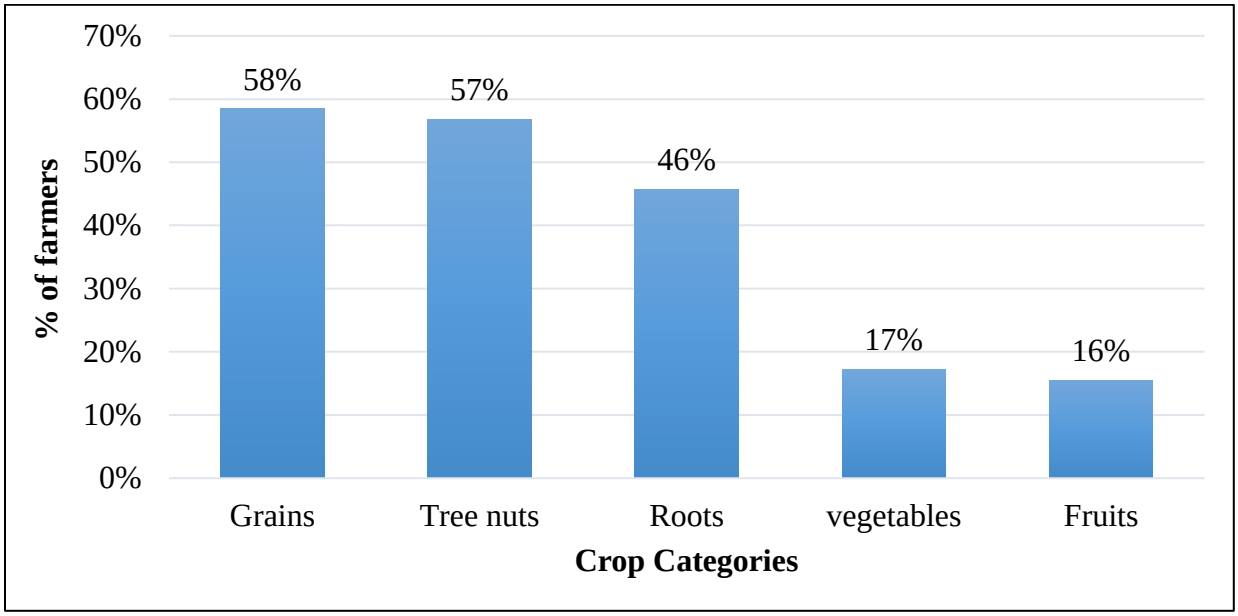


Table 4.1: Proportion of Farmers Producing Multiple Crops Categories (N=354)

	Fruits	**Grains**	**Roots**	**Tree nuts**	**Vegetables**
Fruits	6%	5%	6%	5%	1%
Grains		9%	**26%**	**32%**	9%
Roots			5%	**25%**	8%
Tree nuts				10%	6%
Vegetables					3%

While only 3% of the respondents were involved in four crop categories, 44% of them were involved with two crop categories and 33% were involved with only one crop category (Figure 4. 1). This distribution is not an accident because multiple crop categories may act as a risk management strategy for farm income and also household expense management by the production of crops that serve dual purposes of domestic consumption and commercial. For the vegetable category, the primary aim of the farmers was not to commercialize them therefore they were excluded from further analysis. This study focuses on those whose primary aim was to sell.

Figure 4. 1: Distribution of Respondents by Number of Crop Categories In Which They Are Involved (N=354)

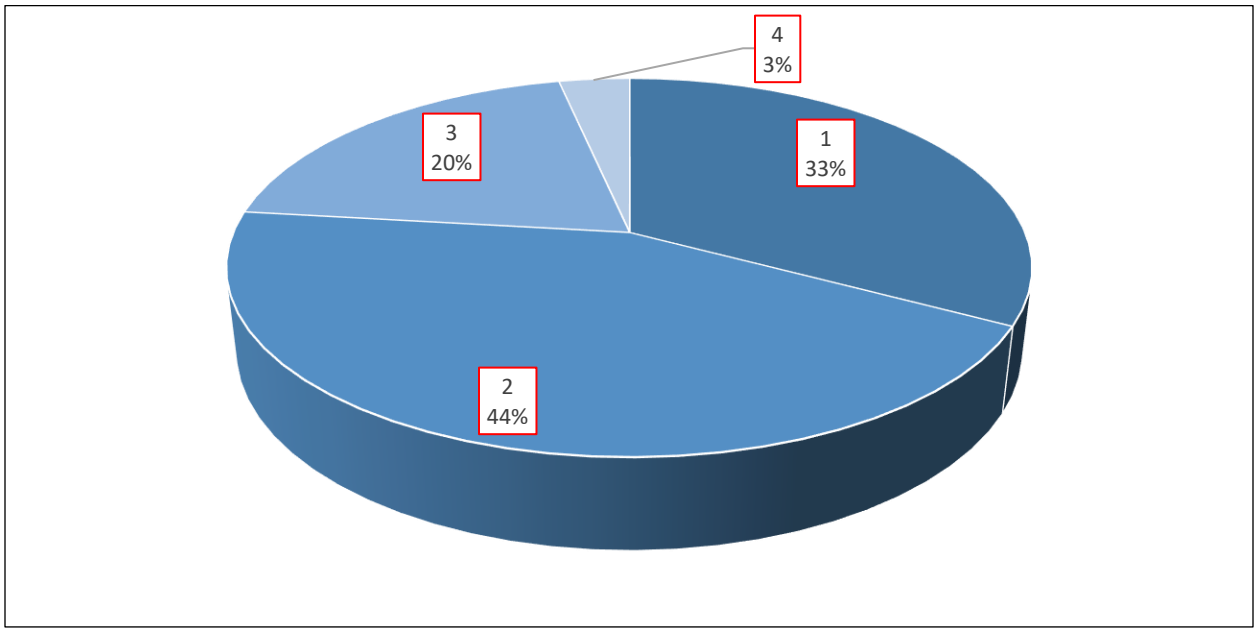


Table 4.2 shows the distribution of farmers for the specific crops they produced. In the fruit category, about a third of the farmers produced mangoes and oranges, lime or lemon. The grains category had 57% and 23% of farmers producing maize and rice respectively. The roots category was dominated by cassava and plantain farmers with a proportion of 50% and 34% respectively. The farmers in the tree nuts category produced two crops, 83% of them produced cocoa and 17% produced cashew.

The results in

Figure 4.2 show that 45% of the farmers participate in inter-organizational relationships while 55% percent do not participate in inter-organizational relationships. Figure 4.3 provides a more detailed representation of farmers' participation status emphasizing the specific crops they produced. It shows the proportion of farmers participating and not participating, based on the observations presented in Table 4.2. Farmers with the highest participation of 100%, 85%, 83%, and 50% produced papaya, mango, pineapple, and coconut respectively which belongs to the fruit

category. This is followed by 42% of cocoa farmers and 28% of cassava farmers who participate in inter-organizational relationships. Farmers who produced the grains, rice; beans; and maize had 14%, 13% and 12% of participants respectively. Following these are the cashew, plantain, cocoyam, and orange farmers (which is a mix of tree nut, root and fruit categories) with about 10% of participants. It can be observed from these results that the farmers producing the highly perishable crops showed high participation in relationships with buyers.

Table 4.2: Distribution of Farmers Producing Specific Crops (N=354)

Crop	**Number of farmers(N)**	**% in category**	**Percent overall**
Fruits	**60**		
Coconut	6	10%	1%
Mangoes	20	33%	3%
Oranges, lime or lemon	21	35%	3%
Papaya	7	12%	1%
Pineapple	6	10%	1%
Grains, legumes & oilseed	**281**		
Beans	15	5%	2%
Groundnuts	14	5%	2%
Maize	161	57%	21%
Oil palm	27	10%	3%
Rice	64	23%	8%
Roots	**235**		
Cassava	118	50%	15%
Cocoyam	10	4%	1%
Plantain	79	34%	10%
Yam	28	12%	4%
Tree nuts	**205**		
Cashew	34	17%	4%
Cocoa	171	83%	22%
Total	**781**		100%

Figure 4.2: Farmers Participation Status In Inter-Organizational Relationships (N=354)

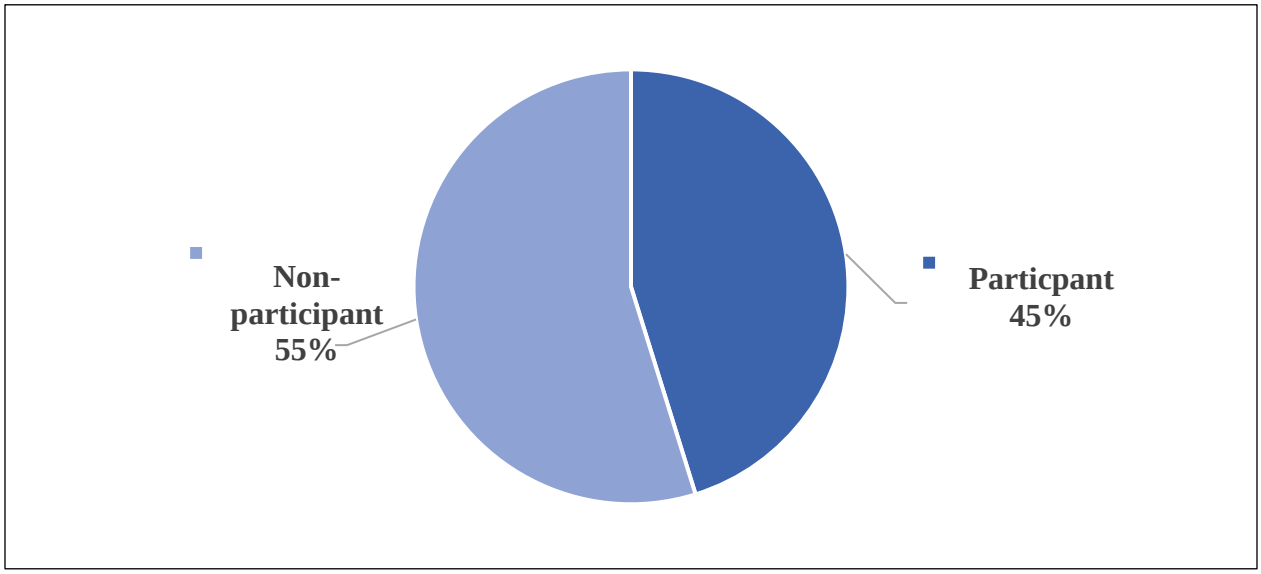


Figure 4.3: Farmers' Participation By Specific Crops (N=781)

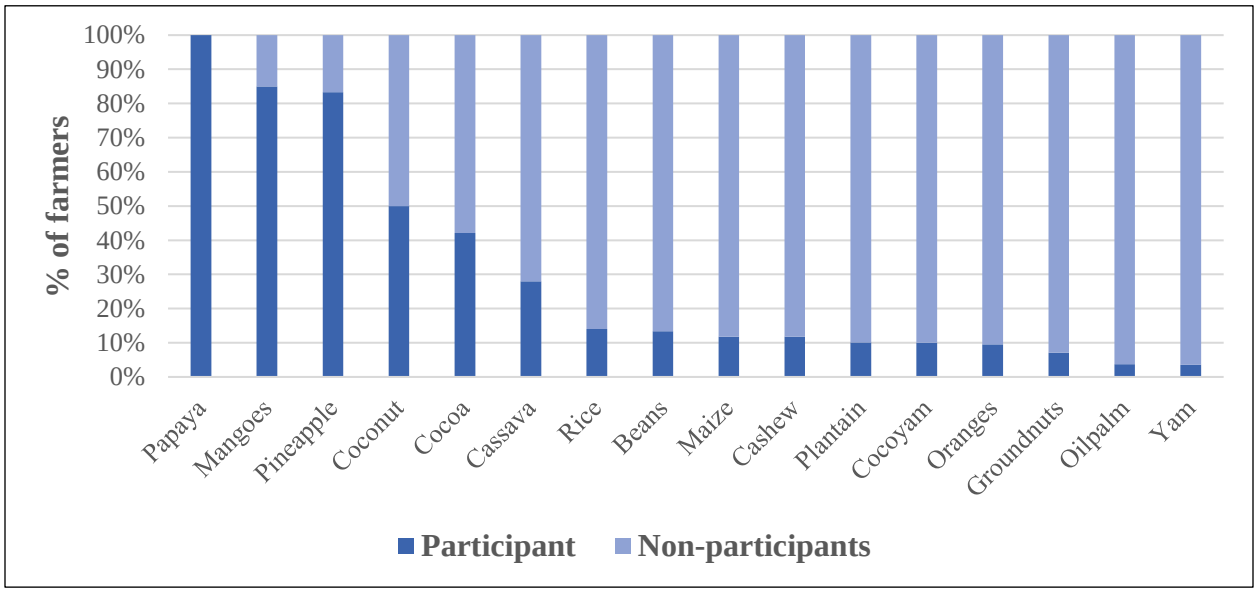
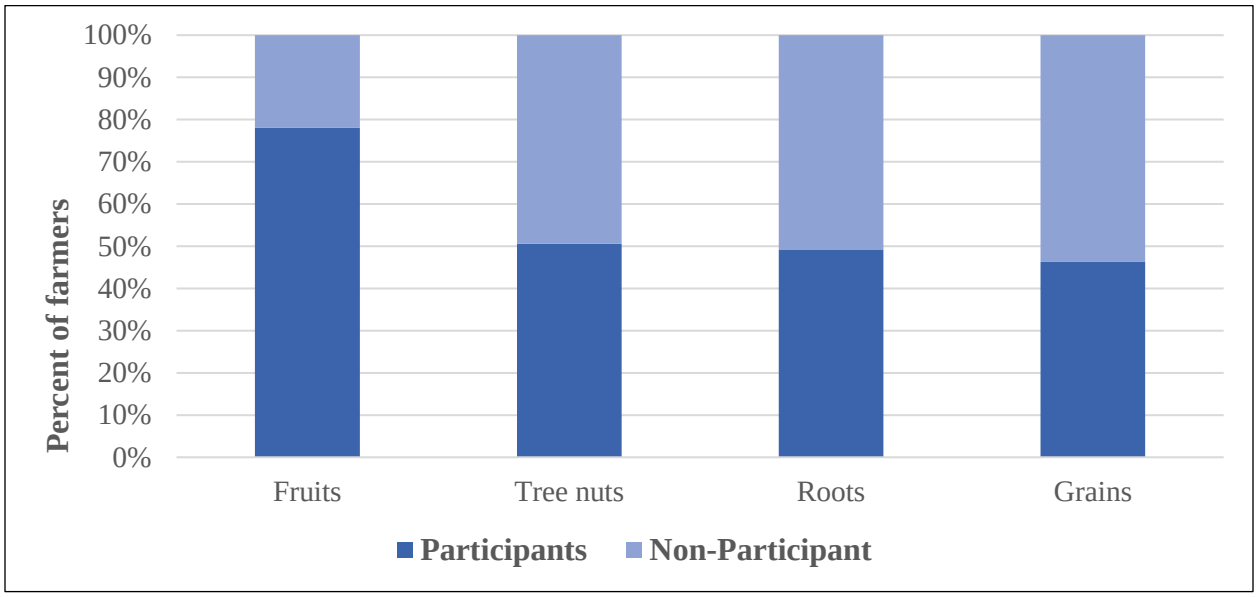


Figure 4.4 shows a summary of farmers' participation status in inter-organizational relationships by crop categories. The summary indicates that fruit farmers had the highest proportion of participants (79%) while the proportion of participating farmers in tree nut, root, and grain category was 51%, 49%, 47% respectively.

Figure 4.4: Farmers Crop Categories And Participation In Inter-organizational Relationships (N=354)



Results of farmers' socioeconomic characteristics in Table 4.3 show that the average age of farmers who participate in relationships and those who do not participate is about 49 years and 46 years respectively. The age difference is found to be significant at a 1% level. The average years of formal education are approximately 10.1 years for participant farmers and 8.8 years for non-participant farmers with a standard deviation of about 4.6 years. This implies that the average education of participants is about senior high school level and that of the non-participant is about a junior high school level. The education gap is found to be significant at a 1% level. Also, participants have significantly higher average years of farming experience, about 20.8 years, compared with the non-participants who have 18.7 years. The average monthly farm income of farmers participating in inter-organizational relationships is approximately GHS 4,158 while farmers who do not participate have an average income of about GHS 1,259. The difference in farm incomes is significant at the 10% level. The off-farm income of participating and non-participating is not significantly different. The standard deviation of the participants' farm and off-farm incomes were GHS21,067 and GHS3059 respectively which suggests that some participants

earned exceptionally high incomes. These results generally indicate that participants in inter-organizational relationships are generally older, more educated and have higher farm incomes compared to non-participants.

Table 4.3: Farmers' socioeconomic characteristics (N=354)

Variable	Non-Participants		Participants		Difference
	Mean	SD	Mean	SD	
Farm income (GHS/month)	1259.24	1736.16	4157.78	21067.77	*
Off-farm income (GHS/month)	2057.23	2618.87	2470.79	3059.75	
Farming experience (years)	18.70	11.38	20.81	10.54	*
Age (years)	46.09	11.76	49.62	12.03	***
Education (years)	8.81	4.61	10.09	4.55	***

Note. * and *** represents significance levels at 10% and 1% respectively

Figure 4.5 presents the farmers' average farmland by the crop enterprises they produce and their participation status in inter-organizational relationships. Fruit farmers who participate in relationships produce on average farmland of 51 acres while non-participants produce on average farmland of 9 acres. The difference between the average farmlands was significant at 1% level (see Table 4.4). The results also show that the grain farmers who are participants, produce on the next highest average farmland of 36 acres. However, the grains, roots, and tree nuts participating, and non-participating farmers show differences in average farmland (Figure 4.5) which were not statistically significant as shown in Table 4.4.

Figure 4.5: Average Farmland of Farmers by Participation and Crop Category (N=354)

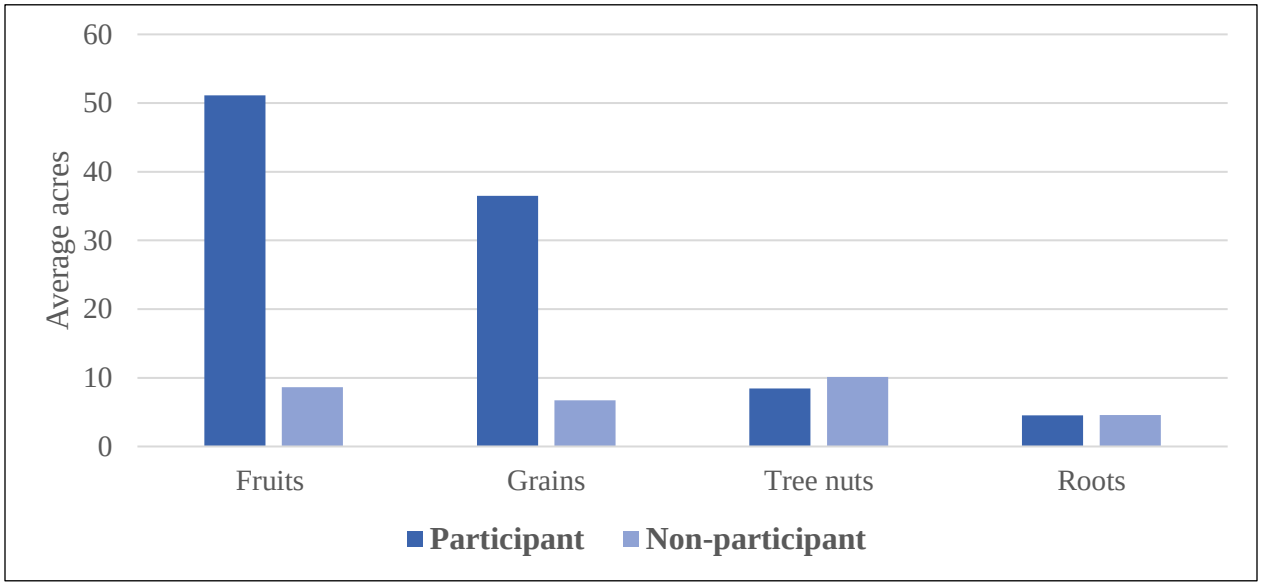


Table 4.4: Test of Significance of Differences in the Average Farmlands for Participants and Non-Participants by Crop Category (N=354)

Crop category	Coefficient	Std. Err.	t	P>t
Fruits	42.455***	12.144	3.500	0.001
Grains	29.774	20.213	1.470	0.142
Roots	-0.082	0.882	-0.090	0.926
Tree nuts	-1.692	1.164	-1.450	0.148

Figure 4.6 presents the distribution of gender and full-time farmers by their participation in inter-organizational relationships. It shows that 78% of farmers who participate in relationships are males and farmers who do not participate also have 78% of them being males. Also, 59% of farmers who participate in such relationships identified farming as their full-time occupation and 50% of non-participants identified the same.

Figure 4.6: Distribution of Male and Full-Time Farmers by Participation in Inter-Organizational Relationships (N=354)

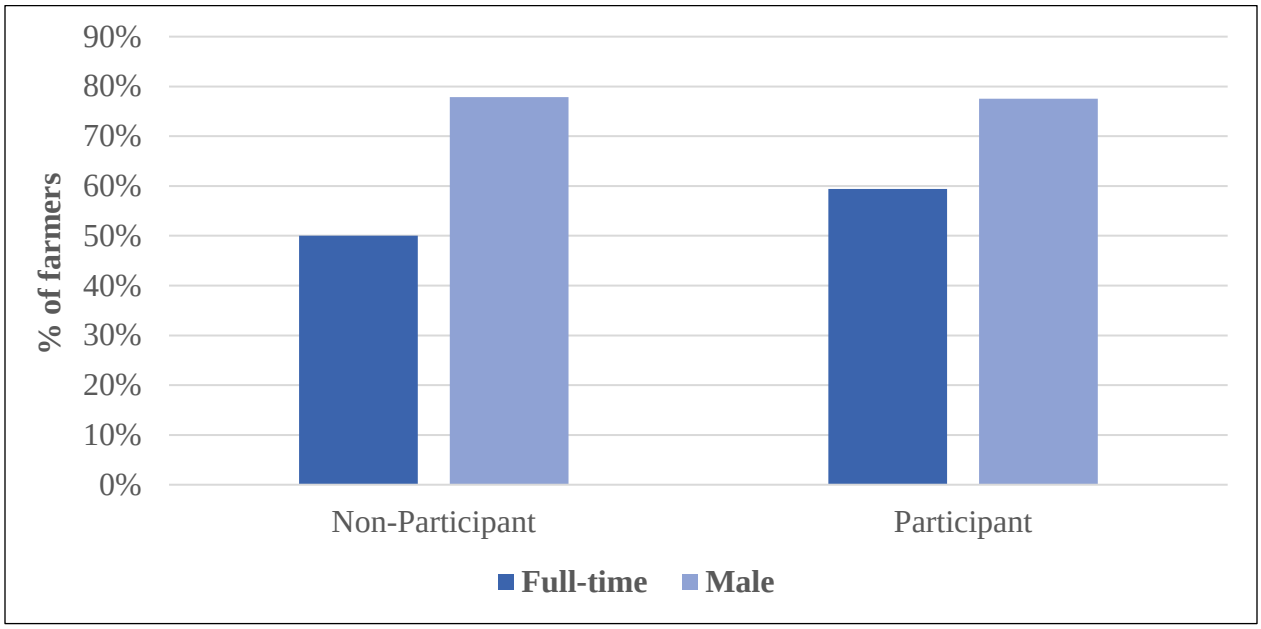


Figure 4.7 shows that male participants, male non-participants, female participants, and female non-participants have respective monthly average farm income of about GHS5,080, GHS1,451, GHS978, and GHS585. Table 4.5 indicates that the farm income gap between the male participants and non-participants is statistically significant at the 10% significance level but the female participants and non-participants do not have a statistically significant difference in average farm incomes. Male and female non-participants have a significant difference in average farm incomes at the 1% significance level. Male and female participants also have a significant difference in farm incomes at the 10% significance level, but female participants and male non-participants do not have a statistically significant difference in average farm incomes.

Figure 4.7: Farm Income by Gender and Participation (N=354)

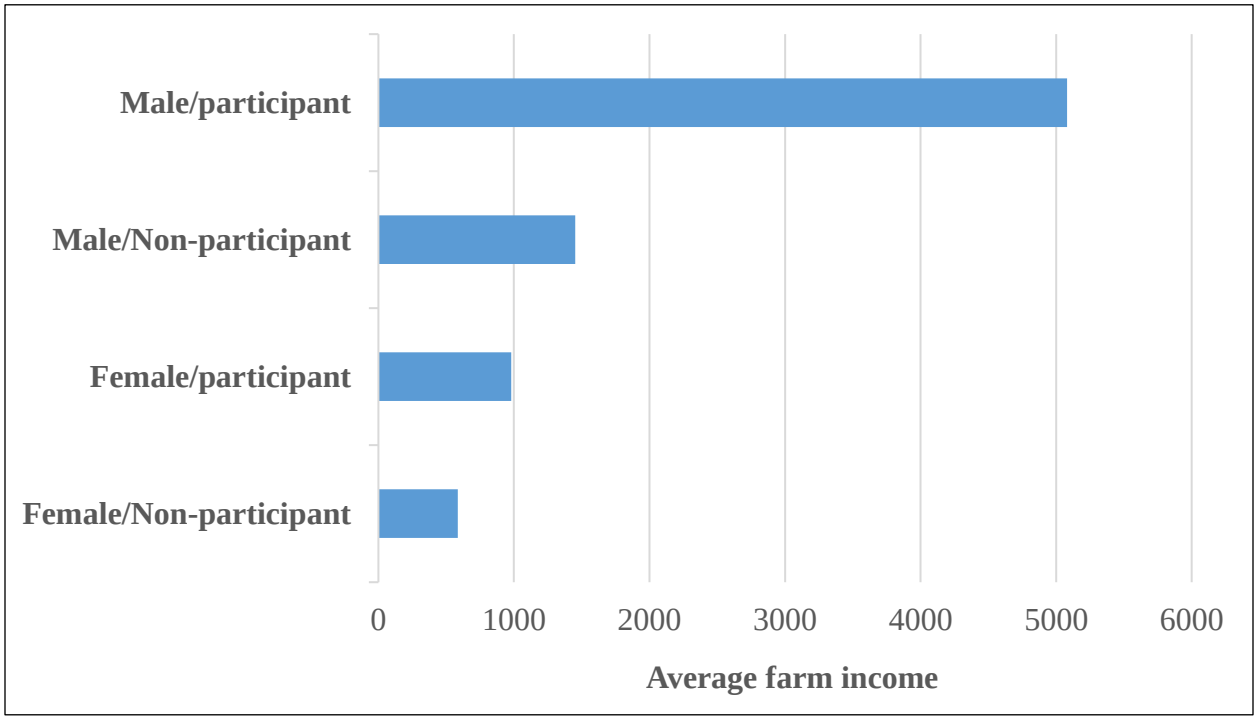


Table 4.5: Test For Significance of the Difference in Average Farm Income by Gender and Participation in Inter-Organizational Relationships (N=354)

Farmer gender and participation in IOR	Coefficient	Std. Err.	t	P>t
Male non-participant/participant	-3629.458*	2147.765	-1.69	0.092
Female non-participant/participant	-393.8146	311.4774	-1.26	0.207
Female/male non-participant	-866.1806***	180.6476	-4.79	0.000
Female/male participant	-4101.824*	2162.701	-1.9	0.059
Female participant/male non-participant	-472.366	334.8731	-1.41	0.159

4.3. Identified typologies of farmers relationships

This objective is focused on identifying and classifying the relationships that farmers participate in, with buyers of their crop products. The analysis is focused on that 45% of farmers who identified themselves as participants in inter-organizational relationships. Three typologies of

inter-organizational relationships were identified from the survey: structure typology; specification typology; and governance typology.

4.3.1. Structure typology

Table 4.6 shows the first typology of farmers' relationship, the structure, constructed based on how farmers developed their relationship with the buyers of their crop products. The evidence from this research shows that direct relationships with the buyer are the most preferred. As shown in the table, 67.5% of the participating farmers surveyed, developed their relationships directly with the buyer. Also, 21.8% of the farmers developed their relationships through the farmer-based organization (FBO) and 4.4% of the farmers used an agent to develop their relationships with the buyer. About 2% of the farmers used a combination of D2B and FBO as well as FBO and Agent to develop their relationships.

Table 4.6: Farmers Method for Developing a Relationship with Buyer (N=160)

Structure of the relationship	Frequency	Percent
Direct to buyer	108	67.5%
Farmer based organization (FBO)	35	21.8%
Agent	7	4.4%
Direct to buyer and FBO	2	1.3%
FBO and Agent	1	0.6%
No Response	7	4.4%

Table 4.7 shows the description of the farmers who use the three methods to develop their relationships. It shows that the characteristics of farmers using direct relationships with buyers are significantly different from farmers using FBOs but farmers using agents are no different from either of the two except in off-farm incomes and farm size. From the table, direct to buyer relationships have 84% of males which is significantly different from the 61% males using the FBO method at the 1% level but no different from the 75% males using agents. It also shows that younger farmers and farmers who have higher incomes, and more educated tend to develop direct

relationships with buyers compared with farmers using FBOs. However, compared with those farmers using agents they are no different. The respective average farm sizes of farmers who use direct relationships with buyers, FBOs, and Agents, are about 50 acres, 16 acres, and 16 acres. The farmers with the 50 acres are significantly different from the other two indicating that farmers with smaller farm sizes prefer using FBOs and Agents.

Regarding the crop enterprises of farmers, 58% and 84% of root crop and tree nut farmers use FBOs compared to 39% and 52% who developed direct relationships with buyers respectively. The difference in the percentages for tree nuts is significant at the1% level indicating that more tree nut farmers preferred to develop relationships through FBOs. Similarly, the difference between the percentages of the root crop farmers is significant at the 10% level indicating that more root crop farmers preferred to develop their relationships through FBOs. The fruit and grain farmers using either of the methods were not statistically different.

Table 4.7: Farmers' Characteristics Relationship Structure Used by Participating Farmers

Farmers' Characteristics	Direct to Buyer (N = 110)		FBO (N= 38)		AGENT (N = 8)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Farm income (GHS/mth)	5,089.23[c]	25,214.58	927.29[c]	927.12	1,976.50	1,531.99
Off-fam income (GHS/mth)	2,764.74[a]	3,387.70	1,315.76[ac]	1,233.10	2,714.00 [c]	1,746.92
Farming experience (Years)	19.97	10.84	22.76	9.27	24.00	12.71
Education (years)	10.45[c]	4.49	9.00[c]	4.27	10.25	5.42
Age (years)	48.36[c]	12.09	52.05[c]	11.23	52.00	10.31
Gender (1=Male)	0.84[a]	0.37	0.61[a]	0.50	0.75	0.46
Farm size (Acres)	50.29[bB]	171.31	16.11[b]	22.39	16.13[B]	9.78
Fruits (1=Yes)	0.25	0.43	0.29	0.46	0.25	0.46
Roots (1=Yes)	0.39[b]	0.49	0.58[b]	0.50	0.50	0.53
Grains (1=Yes)	0.56	0.50	0.47	0.51	0.38	0.52
Tree nuts (1=Yes)	0.52[a]	0.50	0.84[a]	0.37	0.75	0.46

Note. [a], and [c] represents the significance of the difference in means at 1% and 10% levels respectively. [b] and [B] represents the 5% significance levels

4.3.2. Specification typology

The second typology of farmers' relationships, the specification, is constructed based on the focus areas of the relationship. Figure 4.8 Gives detailed specifications of the farmers' arrangements in their relationships with buyers. It shows that farmers' arrangements are focused on quantity, quality, price, and their combinations. The majority of farmers (36%) had a quality only arrangement. This is followed by 22% of the farmers who had a combination of quantity, quality and price specification in their relationship with their buyers. Also, 19% of farmers had a quality and price based specification and 13% had a price only specification with buyers. The remaining farmers, 6%, 3%, and 1% had a relationship specification based on quantity and quality; quantity and price; and quantity only respectively. The relationship specification typology

summarizes that 83% of farmers have a quality focus, 57% have a price focus and 32% have a quantity focus.

Figure 4.8: Focus Areas of Farmers' Relationships (N=160)

Table 4.8 describes farmers who engage either a quantity focus, quality focus, price focus or their combinations in their relationships with the buyers. Farmers in the price-quality-quantity based relationships tend to have the highest average farm incomes of about 14,079GHS/month. It is significantly higher than the farm incomes of the farmers using other specifications at the 10% level except for the price-quality specification (2,894GHS/month) where there is no significant difference. On the other hand, farmers with the lowest average farm income of 360GHS/month prefer quantity only specifications in their relationship. This income is significantly lower compared with the average farm income of farmers using other specifications except for the price-quantity specifications (401GHS/month) where they are not different. Similarly, the average off-farm income of 5,554GHS/month of farmers in the price-quality-quantity based relationships tend to be significantly higher compared with that of the farmers who use other specifications except

for the price-quality specification (2,475GHS/month) where there is no significant difference. Also, farmers with the lowest average off-farm income (470GHS/month) use quantity only specification in their relationships with buyers. This average off-farm income is significantly lower at 1% and 10% level compared with the average off-farm income of farmers using other specifications except for the price-quantity specification where the farmers have about 759GHS/month of farm income. This implies that farmers with the highest incomes, both farm and off-farm prefer price-quality-quantity or price-quality specifications in the relationships with their buyers. Also farmers with the lowest incomes, both farm and off-farm prefer quantity only or price-quantity specifications in their relationships with their buyers.

It is worthy of note that the farmers with the price-quality-quantity specification who have higher average incomes also have higher average years of education of 11.9 years. This is significantly different at 1% and 10% level compared with that of the farmers who use other specifications except for the price-quality specification (11.2years) which is no different. Also, the farmers with the quantity only specification who have lower average incomes tend to have significantly lower average years of education (6 years). However, interestingly the 11.9 years of education of the high-income farmers, the 6years education of the low-income farmers, and the average years of education of the farmers using other specifications are not statistically different from the average years of education of the farmers who use price-quantity specification (6.4years). Thus this reflects the generally low level of education of the Ghanaian farmer.

It is no coincidence, however, that the farmers with the price-quantity specification who have higher average incomes also have higher average farm size (115 acres) because of scale economies (Camanzi, Arba, Rota, Zanasi, & Malorgio, 2018b, p. 5). The 115-acre farm of these farmers is significantly different at 5% and 10% compared with that of farmers who use other

specifications except for the price-quality specification (38 acres) which is no different. Also, the farmers with the quantity only specification who have lower average incomes tend to have significantly lower average farm size (9 acres) than the farmers with the former specifications but no different from the farmers with 10, 12 and 9acres who use other specifications as shown in the table.

The table also shows that the average years of farming experience of farmers who have quantity only and price-quantity specifications are 18.5 years and 18.4 years respectively. However, these are not statistically different compared with the farmers who use other specifications in their relationships. Regarding the farmers' average age, the farmers who use price-quality specifications are significantly older (54years) compared to those with price only (45years) and price-quantity (42years) at the 10% level and the 5% level for price-quality-quantity specifications. However, generally, the average age of all the farmers is not statistically different from farmers who use a quantity only specification with an average age of 43 years and those who use quality-quantity specifications with 51years. Gender distribution shows a statistical difference only between the farmers who use quality only, quality-quantity and price-quality-quantity specifications. The percentage of males among farmers who use the quality only specification is lower (68%) compared to the males who use the quality-quantity specification (90%) at the 10% significance level and the 5% level for those who use price-quality-quantity specification (89%). The gender distribution of the farmers in these three specifications is however no different from the other four specifications in the table. This implies that in general, the gender distribution of farmers with the different focus areas are no different

Regarding the crop enterprises of the specification relationships, the percentage of fruit farmers using price only (5%), quality only (7%) and quantity (0%) are not significantly

different. They are however significantly lower at 5% and 1% level compared to the percentage of farmers using some combination: price-quality (47%); quality-quantity (40%); price-quality-quantity (46%) except for the price-quantity which is no different from any of the specifications. This indicates that specifications that have only one focus compared with those with some combination is not a preference for fruit farmers except the price-quantity specification which is no different.

Concerning root crops, 100% of the farmers who use quantity only and price-quantity specifications produce root crops. This is higher and significant at 1% and 5% compared to the percentage of root crop farmers in other specifications: price only, 38%, price-quality, 53%, quality-quantity, 60%, and price-quality-quantity, 43%. However, the percentage of root crop farmers in all the specifications are not statistically different from the 35% in quality only relationships. Hence the preference may not matter for root crop farmers.

The percentage of grain farmers using any of the specifications in their relationships are not statistically different except between the price only and the price-quality which has 67% and 43% respectively with a significant difference at 10%. It can, therefore, be inferred that the specification does not matter for grain farmers.

The specification used by farmers, however, matters for the farmers in the tree nut enterprise because the percentage of tree nut farmers in each of the specifications are different at the 1%, 5%, and 10% significance levels. The specifications with a higher percentage of tree nut farmers are quantity, quality, and price with 100%, 93% and 80% of farmers respectively. That is when compared with the specifications price-quality; price-quantity; and price-quality-quantity which have 27%, 40%, and 9% respectively. The 93% and 80% are however not different from the farmers who use quality-quantity specification and have 70% producing tree nuts. Therefore,

tree nut farmers prefer to use specifications with only one focus area beginning with the quantity focus and followed by the quality only, price only or quality-quantity specification.

Table 4.8: Characteristics of farmers in the specification typology of relationships (N=160)

Farmers Characteristics	Mean of relationship specifications						
	Price	**Quality**	**Quantity**	**Price-quality**	**Price-quantity**	**Quality-quantity**	**Price-qual-quantity**
N	21	57	2	30	5	10	35
Farm income GHS/mth	1,002.19^{aAcC}	788.18$^{\alpha Pb\ell}$	360.00$^{a\alpha\tau\sigma\chi}$	2,894.43$^{\tau\eta}$	401.80$^{AP\eta\bar{d}\mu}$	1,692.20$^{cb\sigma\bar{d}T}$	14,079.66$^{C\ell\chi\mu T}$
Off-farm income GHS/mth	1,616.95^{cabA}	1,158.61$^{\alpha\bar{d}C\sigma P}$	470.00$^{a\bar{d}\rho\sigma A}$	2,475.60$^{c\alpha\rho\varrho q}$	759.80$^{bC\varrho\flat}$	2,192.20$^{\sigma\flat Q}$	5,554.29^{APqQ}
Farm experience (years)	17.33^{cb}	21.96^{c}	18.50	24.80^{bCB}	18.40	19.30^{C}	18.51^{B}
Education (years)	10.05^{ac}	8.88^{bAbP}	6.00$^{aA\bar{d}\sigma\alpha}$	11.17$^{b\alpha}$	6.40	10.20$^{b\bar{d}T}$	11.89$^{cP\sigma T}$
Age (years)	45.05^{cC}	50.40^{c}	43.00	54.43^{CTb}	41.80^{T}	50.70	48.14^{b}
Gender (1=Male)	0.81	0.68^{cb}	0.50	0.77	0.80	0.90^{c}	0.89^{b}
Farm size (Acres)	10.90$^{bB\beta}$	12.37$^{\theta\underline{b}\flat}$	9.00$^{a\alpha\flat}$	38.27$^{b\theta aA}$	9.00$^{A\delta\varpi}$	24.70$^{\beta\underline{b}ac\varpi}$	115.17$^{B\flat\flat c\delta}$
Fruits (1=Yes)	0.05^{abA}	0.07$^{\alpha B\beta\bar{d}}$	0.00$^{B\sigma\underline{b}}$	0.47$^{a\alpha\sigma}$	0.40	0.40$^{b\beta\underline{b}}$	0.46$^{A\bar{d}}$
Roots (1=Yes)	0.38^{aA}	0.35	1.00$^{a\alpha b\sigma}$	0.53$^{\alpha\bar{d}}$	1.00$^{A\bar{d}BP}$	0.60^{bB}	0.43$^{\sigma P}$
Grains (1=Yes)	0.67^{c}	0.51	0.50	0.43^{c}	0.40	0.60	0.60
Nuts (1=Yes)	0.81^{abA}	0.93$^{\alpha B\beta\sigma}$	1.00$^{bB\bar{d}\flat c\rho}$	0.27$^{a\alpha\bar{d}\underline{b}\delta}$	0.40$^{\beta\flat}$	0.70$^{\underline{b}c\varrho}$	0.09$^{A\sigma\delta\rho\varrho}$

Note. ^{a}, ^{A}, $^{\bar{d}}$, $^{\alpha}$, ^{P}, $^{\sigma}$, $^{\rho}$, $^{\varrho}$, $^{\flat}$, ^{Q} represents the 1% significance difference in means, ^{C}, $^{\ell}$, $^{\chi}$, $^{\mu}$, ^{T} represents the 10% significance difference in means and ^{b}, ^{B}, $^{\underline{b}}$, $^{\delta}$, $^{\flat}$, $^{\varpi}$ represents the 5% significance level

4.3.3. Governance typology

Table 4.9 presents the third typology of farmers' relationships, the governance, which was constructed based on the formality of the agreement between the farmer and the buyer in their relationships. It shows that the governance mechanisms used in farmers' relationships were either formal or informal agreements. The formal agreement is operationalized here as written and legally enforceable agreements which are characterized by low trust between the partners in the relationship. The informal agreement is also defined here as agreements in principle which could be verbal and characterized by high trust between the partners in the relationship. About 69% of farmers identified themselves to have informal agreements with their buyers while 31% identified their relationships to be based on formal agreements.

Table 4.9: Governance mechanisms for farmers relationships with buyers N (160)

Governance	Frequency	Percent
Informal agreement	110	68.8%
Formal agreement	50	31.3%

Table 4.10 describes the farmers who use either formal or informal agreements to govern their relationships. The results show that the average off-farm income of farmers who use formal agreements is about 3537GhS/month and higher and significant at 1% compared to that of farmers using informal agreements which is about 1986GHS/month. The table also shows that farmers with formal agreements had about 12years and 93acres of education and farm size respectively compared with about 9years and 16acres of the same for farmers using informal agreements. The differences are significant at 1% level. This indicates that farmers with higher average years of education and higher averages acres of farm size tend to use formal agreements to govern their relationships. Also, formal agreements are preferred by male farmers. As shown in the table,

formal agreements have 88% male farmers while informal agreements have 73% male farmers. The difference is significant at 5% level.

Regarding the crop enterprises, the difference is significant at 1% level. The respective percentages of fruits, grains and tree nuts farmers in formal and informal agreements are 50% and 15%; 36% and 62%; and 26% and 72%. The difference between the percentage of farmers in formal and informal agreements for each of these enterprises is significant at 1% level. These differences indicate that fruit farmers had more formal agreements while grain and tree nut farmers had more informal agreements. However, there is no difference between the percentage of root crop farmers who use formal or informal agreements.

Table 4.10: Characteristics of farmers in the governance typology (N=160)

Farmers' Characteristics	Formal agreement		Informal agreement		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	
Farm income (GHS/mth)	9,856.42	3,7059.04	1,567.48	2,897.702	
Off-fam inc (GHS/mth)	3,537.80	3,681.42	1,985.78	2,608.516	***
Farm experience (Years)	20.52	9.80	20.95	10.901	
Education (Years)	12.44	4.79	9.02	4.018	***
Age (years)	50.70	13.16	49.13	11.514	
Gender (1=Male)	0.88	0.33	0.73	0.447	**
farm size (Acres)	93.36	247.98	15.95	18.792	**
Fruits (1=Yes)	0.50	0.51	0.15	0.354	***
Roots (1=Yes)	0.36	0.48	0.49	0.502	
Grains (1=Yes)	0.36	0.48	0.62	0.488	***
Tree nuts (1=Yes)	0.26	0.44	0.72	0.452	***
N	**110**		**50**		

Note. ***, **, and * represent significance at 1%, 5%, and 10% levels respectively

4.4. Estimates and comparison of the net benefits associated with the farmers' participation in inter-organizational relationships

It was argued from the conceptual framework in Figure 3.2 that the farmers' socioeconomic, crop enterprises and their motivating factors (which are based on transaction costs)

play a role in shaping farmers' decision to participate in inter-organizational relationships. The binary logit regression results are presented here to give an understanding of the determining factors for the farmers' participation choice. For ease of interpretation, these results are presented as odds ratios that represent the ratio of the probability of participating over the likelihood of not participating.

The 17 transaction cost variables (Table 3.1) were reduced to three variables using the principal component analysis by setting the maximum eigenvalue for inclusion to unity. Table 4.11 shows the variables and the factor loadings generating orthogonality. These three principal components had an orthogonal varimax rho of 0.8258, indicating that they explained about 82.6% of the variance in the 17 variables. The overall Kaiser-Meyer-Olkin measure of sampling adequacy was 0.9043, which is described as "marvelous" (Kaiser, 1974).

The loadings of 17 transaction cost variables were used to classify the components as follows: information availability, sales certainty, and price certainty. Table 4.11 shows that information availability loaded the variables, 11-17 while sales certainty loaded 6-10. Finally, price certainty loaded variables 1-5. These three variables defined the transaction cost variables used as predictors of the farmers' decision to participate or not participate in inter-organizational relationships.

Table 4.11: Principal Component Loadings after Varimax Rotation for Components with Minimum Eigenvalues = 1

	Transaction cost Variable	Mean	S.D.	Component factors		
				Information availability	Sales certainty	Price certainty
1	Assured price	1.87	1.33	-0.03	0.02	**0.49**
2	Price premium	1.66	1.09	0.08	-0.26	**0.36**
3	Knowing price ahead of sale	1.92	1.30	-0.02	0.00	**0.49**
4	Opportunity to improve price when market conditions change	2.10	1.31	0.01	0.02	**0.45**
5	Decreased price variability during the season	2.29	1.34	-0.06	0.10	**0.39**
6	Guaranteed sale	2.12	1.57	-0.01	**0.44**	0.02
7	Avoidance of spoilage resulting from of delay in sales	2.37	1.59	-0.02	**0.41**	0.05
8	Matching production to planned sale	2.43	1.51	0.02	**0.43**	-0.02
9	Reduction in overproduction	2.67	1.50	0.03	**0.40**	-0.01
10	Opportunity to sell all production	2.08	1.58	0.00	**0.45**	0.00
11	Knowing buyers' desired product specifications ahead of production	1.89	1.28	**0.39**	-0.02	0.00
12	Knowing the quantity, the buyer needed from me	2.24	1.47	**0.29**	0.12	0.09
13	Knowing the quality, the buyer expected from me	1.80	1.21	**0.41**	-0.05	-0.03
14	Knowing the delivery times for my product	2.12	1.33	**0.33**	0.03	0.10
15	Knowing the delivery location for my products	1.99	1.33	**0.35**	0.03	0.07
16	Better communication with buyer allows me to better plan	1.61	1.19	**0.42**	-0.01	-0.05
17	On-time payment by partner	1.55	1.19	**0.43**	-0.01	-0.10

Note. Bold and underlined loadings indicate the transaction cost variables that are loading specific component factors.

The results of the binary logit regression in Table 4.12 show that a unit increase in information availability increases the odds ratio of choosing to participate in relationships by 1.479 times more than choosing not to participate. This suggests that farmers value unbiased knowledge

of product quality, quantities, delivery times and location as well as better communication to achieve their economic objectives. Also, a unit increase in sales certainty increases the odds ratio of choosing to participate in relationships by 1.909 times more than choosing not to participate. These estimates are statistically significant at 1%. This suggests that farmers value a guaranteed sale, avoidance of spoilage resulting from delay of sales, matching production to planned sale, reduction in production and every opportunity to sell all products. The table also shows that a unit increase in price certainty increases the odds ratio of choosing to participate in relationships by 1.294 times more than choosing not to participate, and it is statistically significant at 5%. This suggests that farmers value an assured price, price premium, knowing price ahead of the sale, opportunity to improve the price when market conditions change, and decreased price variability during the season. These results imply that the transaction cost variables explain farmers' decision to participate in such relationships with the buyer as hypothesized.

The farmers' socioeconomic characteristics are, however, not statistically significant overall. For example, the odds ratio of choosing to participate in relationships or not, neither increase nor decrease statistically for farmers one year older, more educated or more experienced in farming. Also, a farmer being male, full-time or having a unit higher income (farm and off-farm) neither increases nor decreases the odds ratio of participating as compared to females, part-time farmers or farmers with a unit lower incomes. These results indicate that factors explaining farmers' decision to participate in relationships may not be statistically related to their socioeconomic characteristics.

The results for the crop categories in the table indicate that the odds ratio of fruit farmers choosing to participate in relationships is 4.416 times higher than non-fruit farmers choosing to participate. This is statistically significant at 1%. The fruit enterprise increasing farmers' likelihood

of participating confirms the hypothesis that high perishability of crop products increases the likelihood of participation. The table also shows that the odds ratios of participation for farmers who produce grain, root crop, and tree nut are not significantly different from farmers who do not produce them. This indicates producing grains, roots or tree nuts neither increases nor decreases the odds ratio of choosing to participate compared to the farmers who do not produce them. This is in line with the research hypothesis where it was argued that the grains are dry and durable, tree nuts are also dried after harvest and roots crops allow for staggered harvesting hence they are durable as long as they remain in the soil. They are therefore not perishable and do not show a statistical difference compared to those who do not produce them.

Table 4.13 presents the multinomial logit regression to determine how far the farmers' choice of the method of developing their relationship is predicted by the same covariates in the binary logit model. Farmers can choose to develop their relationship directly with the buyer, through FBOs or other means (Agents and combinations of direct to the buyer, FBO, and agent). Therefore the dependent variable in the model is the categorical variable relationship development with the options: other methods (1), direct with the buyer (2), and FBO (3). The multinomial logit model does not consider the categories of the dependent variable to be in any logical order as an ordered logit regression would do. STATA/IC 14.2 selected the direct with buyer category as the base and hence estimated two models: other methods relative to ‘direct with the buyer’; and FBO relative to ‘direct with buyer’. For ease of interpretation, the result is presented as a relative risk ratio. In general, a relative risk ratio of less than 1 indicates that the outcome is more likely to be in the base group (direct with the buyer).

Table 4.12: Binary Logit Regression Results for Farmers' Participation Decision (N=312)

Odds Ratio	Participation (1=participant)	Std. Err.	z	P>z
Information availability	**1.479*** **	0.162	3.580	0.000
Sales certainty	**1.909*** **	0.210	5.890	0.000
Price certainty	**1.294** **	0.154	2.160	0.030
Gender (1=male)	0.958	0.428	-0.100	0.924
Education (yrs.)	1.045	0.040	1.150	0.248
Farming experience (yrs.)	1.006	0.020	0.300	0.765
Age (yrs.)	0.995	0.019	-0.240	0.807
Full time farmer (1=yes)	1.048	0.376	0.130	0.895
Farm income (GHS)	1.000	0.000	1.560	0.120
Off-farm income (GHS)	1.000	0.000	-0.210	0.837
Fruits (1=yes)	**4.416*** **	2.059	3.190	0.001
Grains (1=yes)	1.125	0.391	0.340	0.734
Roots (1=yes)	1.455	0.479	1.140	0.254
Tree nuts (1=yes)	0.641	0.229	-1.240	0.213
Intercept	0.597	0.545	-0.560	0.572
LR chi2(14)				169.92
Prob > chi2				0.000

Note. ***, **, and * represent 1%, 5%, and 10% significance levels respectively

FBO relative to 'direct with the buyer'

The results show that sales certainty, price certainty, age, full-time farming, fruit, and root enterprises are important in explaining the farmers' decision to develop their relationships through FBOs relative to direct with the buyer. When the certainty of the sale of the farmers' product is increased by one unit, the relative risk for preferring the use of FBO to direct relationship with the buyer would be expected to increase by 1.601 times at the 1% significance level holding other factors constant. This indicates that farmers are more likely to develop their relationships through FBOs relative to relating directly with buyers when the certainty of selling their products increases. Similarly, when the certainty of the prices of the farmers' products increases by one unit, the

relative risk for preferring the use of FBO to direct relationship with the buyer would be expected to increase by 1.339 times at the 5% significance level holding other factors constant.

A year increase in the age of farmers increases the relative risk of preferring the use of FBOs to direct relationship by 1.074 times at the 5% significance level when other factors are held constant. Therefore older farmers are more likely to develop their relationships through FBOs relative to direct relationships with the buyer. On the contrary, being a full-time farmer relative to part-time farmers decreases the relative risk of preferring the use of FBOs to have direct relationships by 0.286 times at the 10% significance level holding other factors constant. This indicates that full-time farmers would rather have direct relationships with buyers over FBOs.

Regarding the crop enterprises, being a fruit farmer relative to non-fruit farmers increases the relative risk of preferring the use of FBOs to direct relationships by 13.99 times at the 1% significance level holding other factors constant. Similarly, being a root crop farmer relative to non-root crop farmers increases the relative risk of preferring the use of FBOs to direct relationships by 3.297 times at the 5% significance level holding other factors constant. This implies that generally, fruit and root crop farmers prefer to develop their relationship through FBOs relative to direct relationships with the buyer.

Other methods relative to direct to buyer

Other methods of developing farmers' relationships include agents and combinations of the agent, FBO and direct relationship with the buyer. The results show that information availability, price certainty, and farmers in the tree nut enterprise are important in explaining the farmers' decision to develop their relationships through other methods relative to directly with the buyer. When information availability increases by one unit between the farmers and their partners, the relative risk for preferring the use of other methods to direct relationship with the buyer would be expected

to increase by 1.498 times at the 1% significance level holding other factors constant. Similarly, a unit increase in the certainty of the prices of the farmers' product increases the relative risk for preferring other methods to direct relationship with the buyer by 1.563 at the 5% significance level holding other factors constant. Therefore farmers are more likely to develop their relationships using other methods relative to relating directly with the buyer when information availability and certainty of prices increase. Farmers in the tree nut enterprise increase the relative risk of choosing other methods relative to the direct relationship with the buyer 10.6 times compared to non-tree nut farmers. This is significant at the 10% level. Farmers' characteristics were not significant in explaining the choice of other relationships relative to direct relationships.

Table 4.13: Assessing Participating Farmers Choice of Relationship Structure Using Multinomial Logit Regression (N=151)

Relative risk ratio	**Other methods**	**Std. Err.**	**FBO**	**Std. Err**
Information availability	1.498***	0.230	1.162	0.138
Sales certainty	0.817	0.172	1.601***	0.242
Price certainty	1.563**	0.304	1.339**	0.190
Gender (1=Male)	0.199	0.227	0.606	0.389
Education (Years)	1.185	0.166	1.053	0.083
Farming experience (Years)	1.053	0.061	0.974	0.035
Age (Years)	0.983	0.058	1.074**	0.038
Full-time farmer (1=Yes)	1.159	1.125	0.286*	0.191
Farm income (GHS/mth)	1.000	0.000	1.000	0.000
Off-farm income (GHS/mth)	1.000	0.000	0.999*	0.000
Fruits (1=Yes)	5.859	6.467	13.990***	12.433
Grains (1=Yes)	0.325	0.280	0.912	0.537
Roots (1=Yes)	2.031	1.739	3.297**	1.853
Tree nuts (1=Yes)	10.624*	13.708	4.159	3.649
Constant	0.002**	0.006	0.003***	0.006
LR chi2(28)				89.1
Prob > chi2				0.000

Note. The dependent variable is the method of relationship development (1) other (2) direct to buyer (3) FBO. Reference category: Direct to buyer

Table 4.14 presents the multinomial logit regression to determine how the choice of the focus area of the farmers' relationships is explained by the same covariates in the binary logit model. Farmers may choose to focus their relationships on price, quality, quantity or their combinations. The dependent variable in the model is the categorical variable, relationship specification with the options: quantity (1), quality (2), price (3), quantity-quality (4), quantity-price (5), quality-price (6), quantity-quality-price (7). However, the categories 1 and 5 were omitted because the number of farmers who selected those options was below six which may not yield a meaningful interpretation. STATA/IC 14.2 selected category 2 (quality specification) as the base and hence estimated four models: price specification relative to quality; quantity-quality specification relative to quality; quality-price specification relative quality; and the quantity-quality-price specification relative to quality.

The table shows that the farmers' choice of a price specification relative to quality specification can be explained by price certainty and the farmer being a grain producer. When the certainty of the farmers' product prices increases by one unit, the relative risk of the farmer choosing a price-focused relationship relative to quality-focused one decreases by 0.209 times. This is significant at a 1% level indicating that farmers are more likely to focus their relationships on quality specifications their price certainty increases. Also, a farmer producing grains relative to not producing grains increases the relative risk of choosing price focus over quality focus by 14.981 times which is significant at 1%. Hence grain farmers are more likely to choose price specifications.

Quantity-quality specifications relative to quality specifications are explained by information availability, sales certainty, fruit, and root crop enterprises. Increasing information availability by one unit increases the relative risk of farmers focusing their relationships on

quantity-quality relative to quality only by 1.493 times. On the contrary, increasing the certainty of farmers selling their products decreases the relative risk of farmers focusing their relationships on quantity-quality relative to quality only by 0.536 times. These are significant at 5% indicating farmers are more likely to focus their relationships on quantity-quality combinations when information availability increases. They are also more likely to focus on quality when sales certainty increases. The results also show that farmers who produce fruits or root crops relative to those do not produce them, increase the relative risk of focusing relationships on quantity-quality relative to quality only by 23.19 times and 14.94 times respectively. This is significant at 5% and implies that fruit and root crop farmers prefer quantity-quality focus over quality only.

Regarding quality-price relative to quality specifications, the results show the important factors explaining them to be information availability, price certainty, the root crop, and tree nut enterprises. Increasing information availability by one unit decreases the relative risk of farmers focusing on quality-price specification relative to quality only by 0.446 times which is significant at 1%. Similarly, increasing the certainty of the farmers' product prices by one unit decreases the relative risk of farmers focusing their relationships on quality-price relative to quality by 0.568 times which significant at 5%. This implies that farmers are more likely to focus their relationships on quality only when information availability and price certainty increases. Also, the farmers who produce roots crops relative to non-root crop farmers increase the relative risk of focusing their relationships on quality-price over quality only by 6.94 times which is significant at the 5% level. Producing tree nuts, however, decreases the relative risk of farmers using quality-price focused relationships relative to quality only by 0.035 which is significant at 1%. Hence tree nuts farmers are more likely to focus their relationship on quality over quality-price.

The final model, quantity-quality-price relative to the quality specification in the table shows the significant explanatory variables to be sales certainty, price certainty, root crops, and tree nuts enterprises. It shows that increasing the certainty of sales of the farmers' products by one unit decreases the relative risk of focusing on the trio quantity-quality-price relative to quality only by 0.232 times which is significant at 1%. Similarly, increasing the price certainty by one unit decreases the relative risk of focusing on the trio combination relative to quality only by 0.549 times which is significant at the 10% level. Root crop farming increases the relative risk of farmers focusing on the trio by 20.717 times which is significant at 5% while tree nut farming decreases the relative risk of farmers focusing on the trio by 0.010 which is significant at 1% level. Hence root crop farmers are more likely to focus on the trio while tree nut farmers are more likely to focus on quality.

From the results, it is clear that the certainty of the farmers' product prices consistently increases the likelihood of farmers focusing on quality relative to other specifications.

Table 4.14: Assessing Participating Farmers Choice of Relationship Specification Using Multinomial Logit Regression (N=151)

Relative risk ratio	Price	Std. Err.	Quantity-quality	Std. Err.	Quality-price	Std. Err.	Quantity-quality-price	Std. Err.
Information availability	1.072	0.204	1.493**	0.278	0.446***	0.117	0.753	0.164
Sales certainty	1.067	0.276	0.536**	0.137	0.844	0.199	0.232***	0.116
Price certainty	0.209***	0.088	1.193	0.277	0.568**	0.142	0.549*	0.171
Gender (1=Male)	1.515	1.584	1.125	1.620	0.266	0.294	0.697	1.019
Education (Years)	0.883	0.107	1.187	0.255	1.116	0.137	1.100	0.146
Farming experience (years)	0.907	0.055	0.933	0.069	1.060	0.062	1.068	0.073
Age	1.019	0.052	0.996	0.067	0.985	0.052	0.945	0.058
Full-timer (1=Yes)	1.362	1.368	5.417	6.888	3.618	4.427	5.905	7.800
Farm income (GHS/mth)	1.000	0.001	1.000	0.001	1.001	0.001	1.001	0.001
Off-farm income (GHS/mth)	1.000	0.000	1.000	0.001	1.000	0.000	1.001	0.000
Fruits (1=Yes)	0.204	0.379	23.191**	34.543	1.770	1.821	1.681	2.173
Grains (1=Yes)	14.981***	15.639	0.795	0.784	4.912	5.065	0.977	1.189
Roots (1=Yes)	1.109	1.008	14.944**	17.825	6.941**	6.507	20.717**	24.957
Tree nuts (1=Yes)	3.943	5.007	3.229	5.554	0.035***	0.043	0.010***	0.015
Constant	0.233	0.591	0.001*	0.004	0.097	0.274	0.080	0.250
LR chi2(56)	263.85							
Prob > chi2	0.000							

Table 4.15 presents the factors that explain how farmers' relationships are managed. The governance of the farmers' relationships is influenced by sales and price certainty, years of education, the grain and tree nut enterprises. Increasing the certainty of sale of the farmers' products increases the odds ratio of choosing formal agreements relative to choosing informal agreements by 1.289 times at the 10% significance level indicating that farmers are more likely to choose formal agreements. On the contrary, increasing the certainty of the prices of farmers' products decreases the odds ratio of choosing formal agreements relative to choosing informal agreements by 0.747 times at the 10% significance level. This indicates that farmers are more likely to use informal agreements when they are more certain about prices. Also, a year increase in education increases the odds ratio of choosing formal agreements relative to informal agreements by 1.118 times. This is not coincidental as more educated farmers may find it easier to comprehend the rigor of formal agreements. Regarding the crop enterprises, farmers producing grains relative to those who do not produce them decreases the odds ratio of using formal agreements relative to informal agreements by 0.393 times at the 10% significance level. Similarly, farmers who produce tree nuts decreases the odds ratio of using formal agreements relative to informal agreements by 0.105 times at the 1% significance level. This implies that grains and tree nuts farmers are more likely to use informal agreements over formal agreements

Table 4.15: Assessing Participating Farmers Choice of Relationship Governance Using Binary Logit Regression (N=158)

Odds Ratio	Governance (1=formal 0=informal)	Std. Err.	z	P>z
Information availability	0.885	0.078	-1.39	0.166
Sales certainty	1.289*	0.173	1.89	0.059
Price certainty	0.747*	0.113	-1.93	0.054
Gender (1=Male)	2.054	1.420	1.04	0.298
Education (Years)	1.118*	0.068	1.83	0.067
Farming experience (years)	0.991	0.032	-0.26	0.791
Age (years)	0.994	0.028	-0.22	0.827
Full-timer (1=Yes)	1.781	1.097	0.94	0.348
Farm income (GHS/mth)	1.000	0.000	0.76	0.445
Off-farm income (GHS/mth)	1.000	0.000	0.54	0.593
Fruits (1=Yes)	1.919	1.158	1.08	0.280
Grains (1=Yes)	0.393*	0.219	-1.67	0.094
Roots (1=Yes)	0.968	0.503	-0.06	0.951
Tree nuts (1=Yes)	0.105***	0.066	-3.57	0.000
Constant	0.261	0.376	-0.93	0.351
LR chi2(14)	77.510			
Prob > chi2	0.000			

4.5. Estimate the hierarchy of inter-organizational relationships in terms of Incremental revenue in Ghana

This section presents the results of the third objective which is focused on estimating which relationship structure, specification or governance yields the highest average incremental revenue in percentage terms. The average percentage of premium prices and the average percentage of products sold are also reported. The premium price percentage is the proportion of the price that accrues on top of an assumed market price of GHS1.00 and the percentage of products sold is the proportion of a hypothetical benchmark of 100units that was sold. The incremental revenue percentage is therefore measured as the product of the price premium percentage and the product

percentage sold. The analysis in this section is based on the crop relationships considered to be most profitable by participating farmers. Table 4.16 shows that about 59% of participating fruit farmers consider the fruit relationship to be their most profitable and mango farmers dominate in this category. The table also shows that about 23% of participating grain farmers consider grain relationships to be their most profitable and maize farmers dominate. The results also show that about 32% and 81% of root crop and tree nut farmers consider the same to be their most profitable. Root crop and tree nut relationships are dominated by cassava and cocoa, respectively.

Table 4.16: Crops Considered to be Most Profitable by Participating Farmers

Crop	Number of farmers(N)		
	Total	Participants	Most profitable Relationship
Fruits	**60**	**45**	**(57.8%)26**
Coconut	6	3	2
Mangoes	20	17	14
Oranges, lime or lemon	21	13	0
Papaya	7	7	6
Pineapple	6	5	4
Grains, legumes &oilseed	**281**	**117**	**(23.1%) 27**
Beans	15	6	0
Groundnuts	14	6	1
Maize	161	63	19
Oil palm	27	14	0
Rice	64	28	7
Roots	**235**	**100**	**(32%) 32**
Cassava	118	53	27
Cocoyam	10	7	0
Plantain	79	35	5
Yam	28	5	0
Tree nuts	**205**	**93**	**(80.6%) 75**
Cashew	34	6	4
Cocoa	171	87	71
Total	**781**	**355**	**160**

Table 4.17 presents the percentage incremental revenue resulting from how the farmers develop their relationships with their buyers. That is the structure-based typology of farmers'

relationships by the crop categories and by the dominant crop for each crop category in Table 4.18. The results in Table 4.17 show that participating farmers who considered the grain relationships to be most profitable developed their relationships only direct with the buyers. They sold an average of about 96% of their products and had an average incremental revenue of 1%. The table also shows that fruit, root crop, and tree nut farmers developed their relationships in three ways, direct with the buyer; through farmer-based organizations and agents. Tree nut farmers regardless of how they developed their relationships sold an average of 100% of their products and the average incremental revenues were no different. Regarding the fruit farmers, most of them developed direct relationships with buyers however, those who used agents had a higher incremental revenue of 45% which is statistically significant at 1%. The incremental revenues of those who used farmer-based organizations were no different from those using either of the two. Finally, the root crop enterprise shows that farmers who developed either a direct relationship with the buyer or through farmer-based organizations had an equal average incremental revenue which was significantly higher than the incremental revenue of 0% from using agents. Using agents yields a 100% sale of products but no premium price hence the incremental revenue of 0%.

Table 4.17: Incremental Revenue under Farmers Relationship Structure by Crop Category

Structure by Crop	**N**	**Price premium (%)**		**Sale (%)**		**Incremental Revenue (%)**	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Fruits	**26**						
Direct to Buyer	22	36[a]	40.21	88[aA]	18.10	34[a]	39.91
FBO	4	28	42.72	100[a]	0.00	28	42.72
Agent	2	45[a]	63.64	100[A]	0.00	**45[a]**	63.64
Grains	**27**						
Direct to Buyer	26	1	4.05	96	10.37	1	4.05
Roots	**32**						
Direct to Buyer	24	30[ab]	39.16	89[bB]	23.36	**28[a]**	37.15
FBO	8	28	32.22	100[b]	0.00	**28[b]**	32.22
Agent	1	0[ab]		100[B]	0.00	0[ab]	
Tree nuts	**75**						
Direct to Buyer	42	8	15.11	100	0.00	8	15.11
FBO	29	9	17.68	100	0.00	9	17.68
Agent	6	7	8.16	100	0.00	7	8.16

Note. [A] and [a] represents the 1% significance level and [B] and [b] represents 5% significance of the differences.

Table 4.18 presents the incremental revenues for the dominant crop in each crop category. The table shows that maize and cocoa enterprises depict the result in the grain and tree nut categories respectively. Maize farmers developed only direct relationships with buyers and had an incremental revenue of 1%. Mango farmers developed relationships directly with buyers, through farmer-based organizations, and agents. Farmers who develop relationships through agents had an incremental revenue of 45% which was significantly higher than 40% received by farmers with direct relationships at the 1% level. However, 45% and 40% incremental revenues are no different from the 28% received by farmers who develop relationships through FBOs. Cassava farmers also develop their relationships using all the three methods: direct with the buyer, through farmer-based organizations and agents. The result indicates that cassava farmers who develop direct relationships with the buyers have the highest average incremental revenue of 35% which is significant at 1% and 5% with Agents and farmer-based organizations respectively. However, in

the root crop category where cassava belongs, Table 4.17, the average incremental revenues of direct relationships with buyers and relationships through farmer-based organizations are equal. Finally, cocoa farmers developed their relationships directly with buyers, through farmer-based organizations, and through agents however, the incremental revenue accrued from using either one of the methods is no different statistically.

Table 4.18: Incremental Revenue under Farmers Relationships Structure by Major Specific Crops

Structure by Crop	**N**	**Price premium (%)**		**Sale (%)**		**Incremental Revenue (%)**	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Mango	**14**						
Direct to Buyer	10	42^{b}	26.73	96	9.56	40^{a}	43.42
FBO	4	28^{b}	36.01	100	0.00	28	42.72
Agent	2	45	40.25	100	0.00	**45**^{a}	63.64
Maize	**19**						
Direct to Buyer	18	1	3.20	99	2.86	1	4.71
Cassava	**27**						
Direct to Buyer	19	38^{a}	29.71	86^{bB}	25.58	**35**^{ba}	38.90
FBO	7	32^{b}	30.83	100^{b}	0.00	32^{b}	32.53
Agent	1	0^{ab}	0.00	100^{B}		0^{a}	
Cocoa	**71**						
Direct to Buyer	40	9	11.85	100	0.00	9	15.37
FBO	27	10	17.45	100	0.00	10	18.15
Agent	4	10	7.87	100	0.00	10	8.16

Note. ^{A} and ^{a} represents the 1% significance level and ^{B} and ^{b} represents 5% significance of the differences.

Table 4.19 summarizes the method of farmers' relationship development that yields the highest incremental revenue by crop. Mango farmers who develop relationships with buyers through farmer-based organizations or agents yield an average incremental revenue that at least as high as developing direct relationships. Direct relationships with buyers yield the highest average incremental revenue for maize and cassava farmers. However, with cocoa farmers, the average

incremental revenue from either direct relationships or through farmer-based organizations is no different.

Table 4.19: Summary of the hierarchy of farmers relationship development in terms of incremental revenue

	Direct to Buyer	Farmer based organization	Agent
Mango		X	X
Maize	X		
Cassava	X		
Cocoa	X	X	X

Table 4.20 presents the percentage incremental revenue resulting from the focus of farmers' relationships with their buyers. That is the specification-based typology of farmers' relationships. The table shows seven possible specifications of the farmers' relationships with their buyers: price only; quality only; quantity only; and combinations of these, price-quality; price-quantity; quality-quantity; price-quality-quantity.

Four specifications showed up among farmers in the fruit enterprises, quality; price-quality, quality-quantity, and price-quality-quantity with respective average incremental revenues of 10%, 61%, 3%, and 30%. The average incremental revenue of the price-quality specification is significantly higher at the 1% level for quality only and quality-quantity focus but the 5% level for the price-quality-quantity focus. The 30% average incremental revenue of the price-quality-quantity focus is significantly higher than the quality-quantity focus at the 5% level but no different from the quality only specification. This indicates that fruit farmers are better off in terms of incremental revenues when they have price-quality specifications in their relationships.

Grain enterprise identifies farmers under five focus areas in their relationships with buyers: price only; quality only, quantity only; price-quality; and price-quality-quantity with respective average incremental revenues of 1%, 0%, 0%, 0%, and 2%. These are not significantly different. This indicates that focusing the relationships in the grain enterprise on some specification does not

pay off in terms of incremental revenue. However, the farmers have the guarantee of selling 100% of their products except those with the trio combination of price-quality-quantity who sell 98% which is significantly lower at the 5% level.

Concerning the root crop enterprises, the table shows that all the seven focus areas are represented in the farmers' relationships with buyers: price only; quality only; quantity only; price-quality; price-quantity; quality-quantity; and price-quality-quantity with respective average incremental revenues of 18%, 0%, 0%, 52%, 21%, 0%, and 9%. The price-quality specification which has an average incremental revenue of 52% is the highest and significantly different from the quality only, quantity only and quality-quantity specifications at 1%. It is also different from the price only, price-quantity and the price-quality-quantity specifications at 10%. The next higher option is price-quantity specification with the 21% average incremental revenue which is significantly higher than those specifications with zero incremental revenue at the 10% level. The specifications with the 18% and 9% average incremental revenue are statistically no different from the specifications with zero incremental revenue. Therefore, for root crop enterprises farmers have better payoff with the price-quality and price-quantity specifications in their relationships with buyers.

Farmers in the tree nut enterprises are identified under five focus areas in their relationships: price only; quality only; price-quality; price-quantity; and quality-quantity with respective average incremental revenues of 6%, 7%, 70%,0%, and 4%. The average incremental revenue of 70% is the highest and significantly different from the other specifications at 5%. The next higher option which is the quality only specification with average incremental revenue of 7% is no different from those specifications with average incremental revenue of 6% and 4% but

significantly different from zero at the 5% level. Therefore price-quality specifications give tree nut farmers the highest payoff followed by the quantity only specification.

Table 4.20: Incremental revenue under farmers relationship specification by crop category

Specification by crop category	**N**	**Price premium (%)**		**Sale (%)**		**Incremental Revenue (%)**	
		Mean	SD	Mean	SD	Mean	SD
Fruits	26						
Quality	2	10^{a}	14.14	$100^{b\beta}$	0.00	10^{a}	14.14
Price-quality	10	64^{aAc}	40.97	83^{bB}	23.59	$\mathbf{61}^{aAc}$	43.96
Quality-quantity	4	3^{Ab}	5.00	$100^{B\theta}$	0.00	3^{Ab}	5.00
Price-quality-quantity	10	33^{bc}	37.13	$91^{\beta\theta}$	11.89	30^{cb}	34.90
Grains	27						
Price	7	1	2.27	90	19.15	1	2.27
Quality	3	0	0.00	100^{b}	0.00	0	0.00
Quantity	1	0		100^{B}		0	
Price-quality	4	0	0.00	100^{β}	0.00	0	0.00
Price-quality-quantity	11	2	6.03	$98^{bB\beta}$	4.19	2	6.03
Roots	26						
Price	3	18^{c}	27.54	100^{C}	0.00	18^{c}	27.54
Quality	1	0^{CfA}		100^{c}		$0^{A\eta}$	
Quantity	2	$0^{a\tau}$	0.00	100^{ℓ}	0.00	$0^{a\tau}$	0.00
Price-quality	13	$56^{cCabB\alpha}$	43.32	$84^{\tau\eta}$	30.15	$\mathbf{52}^{CcaA\alpha}$	42.44
Price-quantity	4	$21^{\ell b\tau}$	23.23	100^{τ}	0.00	$21^{C\ell\tau\eta}$	23.23
Quality-quantity	1	0^{B}		100^{η}		$0^{\alpha\ell}$	
Price-quality-quantity	8	$10^{A\alpha}$	7.56	$93^{Cc\ell\tau\eta}$	10.67	$9^{aA\alpha}$	7.63
Tree nuts	75						
Price	10	6^{b}	0.00	100	0.00	6^{b}	0.00
Quality	53	7^{Ba}	4.39	100	0.00	7^{Ba}	4.39
Price-quality	3	$70^{bB\beta\theta}$	51.96	100	0.00	$\mathbf{70}^{bB\beta\theta}$	51.96
Price-quantity	1	$0^{a\beta\theta}$		100		$0^{a\theta\beta}$	
Quality-quantity	7	4^{θ}	4.82	100	0.00	4^{β}	4.82

Note. ^{b}, ^{B}, $^{\beta}$,$^{\theta}$, represents the 5% significance level and ^{C}, ^{c}, $^{\ell}$, $^{\tau}$, $^{\eta}$**,** represents the 10% significance level and ^{a}, ^{A}, $^{\alpha}$ represents 1% significance levels

The incremental revenues resulting from the focus areas of farmers' relationships are presented for the dominant crop in each crop category in Table 4.21. Mango from the fruit category, maize from the grain category, cassava from the root crop category, and cocoa from the

tree nut category are presented. The results show that mango farmers have the same four focus areas in their relationships as in the general fruit category. The price-quality specification has an average incremental revenue of 93% (61% in fruit category) which is significantly higher at the 1% level compared with the average incremental revenues of other specifications used by mango farmers . This indicates that the price-quality focused relationships yields a better payoff for mango farmers, which is in alignment with what was found for the general fruit.

Maize farmers are identified under four kinds of specifications in their relationships but the general grain category where maize belongs has five specifications. However, just as the grain category, the payoffs are no different regardless of the specifications the maize farmers use. The average incremental revenues are about 0% but they have the guarantee of selling 100% of their maize.

The table also shows that cassava farmers focus their relationships on four areas: price only; price-quality; price-quantity; and price-quality-quantity, the price component being consistent. These specifications have average incremental revenues of 25%, 52%, 21%, and 9%. The price-quality specification which has an incremental revenue of 52% is significantly higher than the price-quantity and price-quality-quantity specifications at the 10% and 1% significance levels respectively. However, it is not significantly different from the price only specification which has an average incremental revenue of 25%. The root crop category where cassava belongs exhibits seven categories but cassava farmers have four with price inclusive in each of them.

Finally, cocoa farmers are identified to focus their relationships on four specifications: price only; quality only; price-quality; and quality-quantity with respective average incremental revenues of 6%, 7%, 70%, and 5%. Regardless of the specifications that the cocoa formers had, they were all able to sell 100% of their cocoa. This is attributable to cocoa being an important crop

for its export value. The price-quality relationship with 70% average incremental revenue is significantly higher than at the 5% level but no different from the price only specification that has the 6% average incremental revenue. This indicates that the price-quality and price only specifications in cocoa farmers' relationships gives a higher payoff.

Table 4.21: Incremental Revenue of Farmers Relationship Specification by Major Crop

Specification by major crop	N	Price premium (%)		Sale (%)		Incremental Revenue (%)	
		Mean	SD	Mean	SD	Mean	SD
Mango	**14**						
Quality	2	10 ^{a}	14.14	100^{C}	0.00	10^{ac}	14.14
Price-quality	4	93 $^{aA\alpha}$	2.89	100^{c}	0.00	**93**$^{aA\alpha}$	2.89
Quality-quantity	2	5 ^{A}	7.07	100$^{\ell}$	0.00	5^{Ab}	7.07
Price-quality-quantity	9	37 $^{\alpha}$	42.74	93 $^{\ell cC}$	9.68	40$^{\alpha cb}$	33.97
Maize	**19**						
Quality	3	0	0.00	100	0.00	0	0.00
Quantity	1	0		100		0	
Price-quality	4	0	0.00	100	0.00	0	0.00
Price-quality-quantity	10	2	6.32	98	3.63	2	6.32
Cassava	**27**						
Price	2	25	35.36	100^{Cc}	0.00	25	35.36
Price-quality	13	56 ^{ba}	43.32	84$^{C\ell}$	30.15	**52**^{ac}	42.44
Price-quantity	4	21 ^{b}	23.23	100$^{\ell\tau}$	0.00	21^{c}	23.23
Price-quality-quantity	8	10 ^{a}	7.56	93$^{c\tau}$	10.67	9^{a}	7.63
Cocoa	**71**						
Price	10	6 $^{\beta}$	0.00	100	0.00	6$^{\beta}$	0.00
Quality	52	7 ^{b}	4.32	100	0.00	7^{b}	4.32
Price-quality	3	70 ^{bB}	51.96	100	0.00	**70**^{bB}	51.96
Quality-quantity	5	5 $^{B\beta}$	5.02	100	0.00	5$^{B\beta}$	5.02

Note. ^{b}, ^{B}, $^{\beta}$,$^{\theta}$, represents the 5% significance level and ^{C}, ^{c}, $^{\ell}$, $^{\tau}$, $^{\eta}$**,** represents the 10% significance level and ^{a}, ^{A}, $^{\alpha}$ represents 1% significance levels

The summary of the hierarchy of farmers relationship specification in Table 4.22 shows that in terms of incremental revenue, mango farmers are better off focusing their relationships on price-quality specifications or price-quality-quantity specifications. Cassava and cocoa farmers are better off with a price-quality or price only specification in their relationships with buyers. Maize farmers, however, would have the same average incremental revenue regardless of the focus of their relationships. Generally, farmers would do well with a price-quality focus in their relationships

Table 4.22: Summary of the hierarchy of farmers relationship specifications in terms of incremental revenue

	Price	Quality	Quantity	Price-quality	Price-quantity	Quality-quantity	Price-quality-quantity
Mango				X			
Maize		X	X	X			X
Cassava	X			X			
Cocoa	X			X			

The incremental revenue that accrues from how the relationships between the farmers and the buyers are governed i.e. the governance-based typology of relationships is presented in Table 4.23. The governance mechanisms are shown as formal and informal agreements. Where formal agreements are legally enforceable and characterized by a low trust but informal agreements are not legally enforceable but characterized by high trust.

The results show that fruit, grains, root crops, and tree nut farmers use both formal and informal agreements to govern their relationships. Fruit farmers who use formal agreements have an average incremental revenue of 37% and those who use informal agreements have an average incremental revenue of 35% however they are not statistically different. Grain farmers regardless of whether they use formal or informal agreements have about 0% average incremental revenue however they can sell 98% and 96% of their grains respectively.

The table also shows that farmers in the root enterprise who use formal agreements to govern their relationships had an average incremental revenue of 67% while those who used

informal agreements had 13% which is significantly lower at the 1% level. This indicates that root crop farmers are better off using formal agreements to govern their relationships.

Regarding the tree nut enterprises, the average incremental revenue of farmers who used formal agreement is no different from farmers who used informal agreements in their relationships with buyers. This implies that the governance mechanism does not matter in terms of incremental revenues for farmers. Finally, farmers in the vegetable enterprise used only informal agreements.

Table 4.23: Incremental Revenue under Farmers Relationship Governance by Crop Category

Governance	**N**	**Price premium (%)**		**Sale (%)**		**Incremental Revenue (%)**	
by crop category		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Fruits	26						
Formal	20	38	39.95	90	18.17	37	40.50
Informal	6	38	46.65	88	14.72	35	44.21
Grains	26						
Formal	7	0	0.00	98	4.20	0	0.00
Informal	19	1	4.72	96	12.13	1	4.72
Roots	32						
Formal	9	72***	35.53	94	16.67	67***	35.19
Informal	23	13***	21.56	91	22.33	13***	21.59
Tree nuts	75						
Formal	10	16	29.49	100	0.00	16	29.49
Informal	64	8	12.52	100	0.00	8	12.52

Note. *** represents 10% significance level

The incremental revenue from how farmers govern their relationships with buyers is also presented for specific crops, Table 4.24, which is the dominant crop in each crop category. Mango farmers who use formal agreements in their relationships have an average incremental revenue of 45% and those who use informal agreements have 45%. The difference is however not significant indicating that the governance mechanism does not matter in terms of incremental revenue for mango farmers. Similarly, the average incremental revenue of maize and cassava farmers use either formal and informal agreements to govern their relationships is not different. However,

regarding cassava farmers, those who govern their relationships through formal agreements have an average incremental revenue of 67% compared to 16% for those who use informal agreements. This difference is significant at the 1% level and indicates that cassava farmers are better off using formal agreements to govern their relationships.

Table 4.24: Incremental Revenue under Farmers Relationship Governance by Major Crop

Governance	**N**	**Price premium (%)**		**Sale (%)**		**Incremental Revenue (%)**	
by major crop		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Mango	14						
Formal	10	43	41.31	96	8.45	44	36.88
Informal	4	48	55.00	98	5.00	45	51.96
Maize	18						
Formal	7	0	0.00	98	4.20	0	0.00
Informal	11	2	6.03	100	0.60	2	6.03
Cassava	27						
Formal	9	72***	35.53	94	16.67	67***	35.19
Informal	18	17***	23.33	88	24.74	16***	23.48
Cocoa	70						
Formal	10	16	29.49	100	0.00	16	29.49
Informal	60	8	12.77	100	0.00	8	12.77

Note. *** represents 1% significance level

The summary of the hierarchy of farmers' relationship governance in terms of incremental revenue is presented in Table 4.25. It shows the incremental revenues for mango, maize, and cocoa are not different under formal or informal agreements governance. Cassava farmers, however, are better off using formal agreements to govern their relationships.

Table 4.25: Summary of the hierarchy of farmers relationship governance in terms of incremental revenue

Crop	Formal agreements	Informal agreements
Mango	X	X
Maize	X	X
Cassava	X	
Cocoa	X	X

Chapter 5 Summary, conclusion, policy recommendations

5.1. Summary

This study sought to address the problem that inter-organizational relationships may not be valued by all farmers and the types may differ for those who value it. The motivation was that farmers are faced with the decision of how to sell their farm products. The farmer could sell in the spot market after production or develop some kind of relationship with potential buyers and sell to them when they harvest. Interests in inter-organizational relationships have been stimulated in Ghana in recent years by policies seeking to reduce farmers' market risks while improving processors' access to agricultural products meeting desired quality and availability (MoFA, 2007, 2017). This is premised on the belief that spot markets do not favor farmers because of information asymmetry and small landholding (4ha) compared to processors and other buyers who demand output from several hundred hectares. The participatory nature of developing a relationship is thought to overcome some of the challenges that farmers face using spot markets (Wagner, 2015). However, the coexistence of both spot markets and farmer-buyer relationships presuppose that farmers must be having some gains in each case.

The research question, therefore, was this: what factors motivate farmers who participate in inter-organizational relationships and to what is the hierarchy of the relationships based on incremental revenue? The answer to the research question, therefore, provides insights into policies that may be implemented to support farmers' ability to fully exploit these inter-organizational relationships to achieve their economic objectives. The main objective of the study was to find out what factors motivate farmers who participate in inter-organizational relationships and what is the hierarchy in terms of incremental revenue. Three specific objectives were addressed to achieve the main objective. (1) To identify and classify the typologies of inter-

organizational relationships in which farmers participate to sell their farm products in Ghana, (2) to estimate and compare the net benefits associated with the farmers' participation in relationships with buyers in Ghana and (3) to estimate the hierarchy of the typologies of relationships in terms of incremental revenue in Ghana.

The transaction cost and human action theories were recruited to provide an understanding of the factors that motivate farmers to participate in relationships with the buyers of their farm produce. By the transaction cost theory of the firm (Williamson, 1975; 1985a), it was argued that the value perceived by firms involved in an inter-organizational relationship is greater than the value of not participating. In the same token, those with the option to participate and choose not to participate may be perceiving the value emanating from their participation to be lower than their participation costs. This is not contradicted by the human action theory (Von Mises, 1966) which allows an assertion that the decision of a farmer to participate in relationships with buyers of their farm produce is purposeful behavior that is based on rational considerations. The study, therefore, hypothesized that reducing transaction costs increases the likelihood of farmers participating in relationships with buyers. It was also hypothesized that farmers are likely to participate in relationships based on the perishability of the crop they produced. Data on farmers' socioeconomic characteristics, crop enterprises, and transaction costs were collected from 354 farmers in Ghana. The binary logit regression, multinomial logit regression, t-tests, charts, and percentages were used to analyze the data and present the results.

The results of the study showed that 55% of farmers sell their farm products through the spot market compared to 45% who sell theirs by developing relationships with their buyers. The typologies of the farmers' relationships were determined based on how farmers develop their relationships, the focus areas of their relationships and the mechanisms used to govern them.

It was found that about 68% of the participating farmers developed direct relationships with buyers, 22% developed their relationships through FBOs and 6% developed their relationships using other methods (agents and combinations of agents, FBOs, and direct relationships). The study also revealed that farmers who used FBOs were on average older farmers, farmers with smaller farms, and farmers in the tree nut and root crop enterprises compared with farmers with direct relationships. On the other hand, farmers who developed a direct relationship with buyers were on average more educated and had higher incomes both farm and off-farm. The characteristics of farmers who used agents were not significantly different from farmers who used FBOs and direct relationships except in incomes.

The study also found that farmers focused their relationships on price, quality, quantity or their combinations. The majority of the participating farmers, 83% had a quality focus, 57% had a price focus and 32% had a quantity focus. That the percentages do not add up to 100% indicates that some of the farmers' relationships had more than one focus. Farmers who focused on the combinations price-quality-quantity and price-quality specifications had the highest average incomes. Also, farmers with the lowest incomes, both farm and off-farm preferred quantity only or price-quantity specifications in their relationships with their buyers. For fruit farmers, specifications that had only one focus were not a preference compared with those that had some combination except the price-quantity specification. One the contrary, tree nut farmers preferred relationships which had only one focus area. However, for root crop, vegetable and grain farmers the focus area did not matter.

About 69% of farmers identified their relationships to be governed by informal agreements while 31% identified their relationships to be governed by formal agreements. Females tend to prefer informal agreements in relationships compared to males. The farmers using formal

agreements had higher average off-farm incomes. Farmers with higher average years of education and higher averages acres of farmland tend to use formal agreements to govern their relationships. Also, fruit farmers preferred formal agreements while grain and tree nut farmers preferred informal agreements. However, for root crop and vegetable farmers, the percentage of farmers using formal and informal agreements was not statistically different.

The results of binary logit regression aimed at providing an understanding of the factors that motivate farmers' participation show that the fruit enterprise and the factors that reduce transaction costs: information availability, sales certainty, and price certainty are significant factors. Farmers' characteristics, grain, root crop, and tree nut enterprises were not significant factors. The odds ratio of fruit farmers participating in relationships is 4.416 times higher than the odds ratio of non-fruit farmers choosing to participate. A unit increase in the information availability increases the odds ratio of participating in relationships by 1.48 times more than choosing not to participate. Also, a unit increase in sales certainty increases the odds ratio of choosing to participate in relationships by 1.91 times more than choosing not to participate. Finally, increasing the farmers' certainty of prices increases the odds ratio of participating in relationships by 1.294 times more than choosing not to participate. The transaction cost factors confirm the hypothesis that reducing transaction costs increases farmers' participation in relationships. The odds ratios of the farmers' socioeconomic characteristics were not statistically significant indicating that the factors explaining farmers' decision to participate in relationships may not be statistically related to their socioeconomic characteristics.

The fruit enterprise had a positive effect on farmers thus confirming the hypothesis that high perishability of crop products increases participation. The grain, root crops, and tree nut enterprises were not significant. This indicates producing grains, roots or tree nuts neither increases

nor decreases the odds ratio of choosing to participate compared to the farmers who do not produce them because they are not perishable.

The multinomial logit regression to determine how far the farmers' choice of the method of developing their relationship is predicted by the same covariates in the binary logit model shows some variables to be significant. The regression produced two models: FBOs relative to direct to buyer and other methods relative to direct to buyer. The results showed that sales certainty, price certainty, age, full-time farming, fruit, and root enterprises were significant in explaining the farmers' decision to develop their relationships through FBOs relative to direct to the buyer. A unit increase in the certainty of sale and prices of the farmers' product increased the relative risk of developing relationships through FBOs relative to direct to the buyer. Likewise, full-time farming, fruit, and root crop enterprises increased the farmers' preference for relationships developed through FBOs over direct relationships with the buyers. However, a unit increase in age decreased the relative risk of farmers preferring relationships developed through FBOs over direct relationships with buyers. The results also showed that information availability and price certainty were significant in explaining the farmers' decision to develop their relationships through other methods relative to directly with the buyer. Other methods include agents and combinations of methods. Hence a unit increase in information availability and the farmers' certainty of product prices increases the preference for other methods over direct relationships with the buyer.

The multinomial logit to assess the factors that determined the focus areas of farmers' relationships found that increasing the certainty of farmers' product prices, increased the likelihood of farmers focusing on quality specification relative to all other possible specifications in the relationship.

Finally, the study estimated the hierarchy of the typologies of farmers' relationships in terms of incremental revenue and based on the farmers' crop enterprises. Four crops, mango, maize, cassava and cocoa from the four crop categories fruits, grains, root crops, and tree nut were assessed. Regarding incremental revenues based on how farmers developed their relationships, Mango farmers who used agents to develop their relationships had an average incremental revenue of 45% which was significantly higher at 1% compared with those with direct relationships who had 40%. However, the incremental revenue of 45% and 40% were no different from those using FBOs who had a 28% average incremental revenue. The outcome of the mango farmers was also reflective of the general fruit category. Maize farmers had only direct relationships and average incremental revenue of 1%. Also, cassava farmers who developed direct relationships with buyers had the highest average incremental revenue of 35% but cocoa farmers' average incremental revenue was statistically no different regardless of the method used to develop their relationships. Regarding the focus of farmers' relationships, the price-quality and price-quality-quantity focus may yield similar but better payoff compared with other specifications for mango farmers, however, the general fruit category indicates that the price-quality specification yields the highest payoff. With maize, the average incremental revenues are about 0% for each of the areas that the farmers focus but they have the guarantee of selling 100% of their maize. Cassava farmers use four kinds of specifications in the relationship with the buyer, the price-quality specification yields a higher average incremental revenue of 52% than the other specifications except for the price only specification (25%) which was not statistically different. For cocoa farmers, the price-quality and price only specifications in their relationships gave a higher payoff.

Regarding the average incremental revenues base on the mechanisms that govern farmers' relationships, the results showed that for all the crop enterprises the difference in the average

incremental revenue of farmers who use formal agreements and informal agreements was not statistically significant except for cassava. Cassava farmers who used formal agreements had an average incremental revenue of 67% while those who used informal agreements to govern their relationships had 16%.

5.2. Conclusion

This research sought to contribute to the literature on inter-organizational relationships in the agri-food sector. The decision of how to sell farm produce is an economic imperative for the farmer. Farmers sell their products through the spot market after the harvest or they may have some kind of relationship with an agro-processor, wholesalers or other buyers before production to sell to them. Recent agricultural policies in Ghana seeking to reduce farmers' market risks and ensure agro-processors access to farm products has sparked interests in farmer-buyer relationships. However, the coexistence of spot markets and relationships, by the transaction cost and human action theories, indicates that farmers must be having some gains with the choice they make. Hence, such relationships may not be valued by every farmer and the types may differ for those who value it. The main objective of this research was to provide an understanding of the factors the motivate farmers to participate in inter-organizational relationships and the hierarchy of the relationships in terms of incremental revenue in Ghana. An understanding of the farmers' gains from such relationships would enable policymakers to better help farmers to achieve their economic objectives while minimizing the challenges they present.

The specific objectives were to identify the typologies of the relationships that exist between farmers and buyers in Ghana; to estimate the factors motivating farmers participation, and to rank the typologies in terms of incremental revenue. To achieve these objectives data on

farmers' characteristics, transaction costs and crop enterprises were collected from crop farmers in Ghana.

The study's results indicate that close to half of the farmers participate in some relationship with buyers to sell their farm products and the others sell their products in the spot market. The majority of the participating farmers developed their relationships directly with the buyers, followed by those who use farmer-based organizations and a few farmers who use agents and some combination of methods. Also, most of the farmers' relationships are focused on the quality specifications of the product. This is followed by the farmers whose relationships are focused on the combination price-quality-quantity and the price-quality combination. Relationships with a quantity only focus was the least patronized by farmers. About two-thirds of the farmers' relationships are governed by informal agreements and the other third are governed by formal agreements.

The binary logit regression used to analyze the factors that motivate farmers to participate in relationships indicates that as hypothesized reducing transaction costs indeed increases the odds of farmers choosing to participate compared to choosing not to participate. It shows that increasing the variables information availability, price certainty and sales certainty increases the odds of farmers choosing to participate compared to choosing not to participate. However, the odds ratio of the socioeconomic characteristics was not statistically significant indicating that the factors explaining farmers' decision to participate in relationships may not be statistically related to their socioeconomic characteristics. The fruit enterprise increased the odds of farmers choosing to participate thus confirming the hypothesis that high perishability of crop products increases participation. The grains, root crops, and tree nut enterprises were not statistically significant which was expected because they are not perishable.

The multinomial logit regression to determine how far the farmers' choice of the method of developing their relationship is predicted by the same covariates in the binary logit model shows some variables to be significant. It showed that sales certainty, price certainty, full-time farming, fruit, and root enterprises increased the relative risk of the farmer choosing to develop their relationships through FBOs relative to direct to the buyer. Aging, however, decreased the relative risk of the farmer choosing to develop their relationships through FBOs relative to direct to the buyer. The results also showed that increasing information availability and price certainty increased the relative risk of farmers choosing to develop their relationships through other methods relative to directly with the buyer. Regarding the explanation for farmers' focus areas in their relationships, increasing the certainty of farmers' prices increases the likelihood of farmers focusing their relationships on quality relative to all other possible specifications.

The hierarchy of the farmers' relationships in terms of incremental revenue indicates that mango farmers are better off developing their relationships through agents or FBOs and focusing on price-quality or price-quality-quantity specifications. However, whether they choose formal or informal agreement would not matter in terms of incremental revenue. Maize farmers are better off developing their relationships directly with the buyer however, the choice of the focus area and the governance mechanism makes no difference. Cassava farmers are also better off developing their relationships directly with the buyer, focusing on price-quality or price only specifications and using formal agreements to govern their relationships. Finally, for cocoa farmers, any method they use to develop and govern their relationships would not make any difference in terms of incremental revenue, however, they are better off focusing their relationship on price-quality or price only specifications.

5.3. Policy recommendations

This study was carried out to provide an understanding of the factors that motivate farmers to participate in relationships with buyers and the hierarchy of the typologies of the relationships in terms of incremental revenue. Thus it promises insights into policies that may be implemented to support farmers' ability to fully exploit these inter-organizational relationships to achieve their economic objectives while minimizing the challenges they present.

Table 5.1 shows 9 key findings of the study and their respective policy implications. The first 4 are the farmers' motivation factors for participating in relationships with buyers and the next 5 are the hierarchy of farmers' relationships in terms of incremental revenue. The first shows that increasing information availability increases the odds of farmers participating in relationships suggesting that farmers value unbiased knowledge of product quality, quantities, delivery times and location as well as better communication to achieve their economic objectives. Therefore, to increase farmers' participation in relationships with potential buyers such as agro-processors, wholesalers or aggregators and traders, measures that enhance transparency can be promoted by advocates of such relationships. The second key finding is that increasing sales certainty of farmers' products increases the odds of farmers participating in relationships. This suggests that farmers value a guaranteed sale, avoidance of spoilage resulting from delay of sales, matching production to planned sale, reduction in production and every opportunity to sell all products. Therefore, to increase farmers' participation in relationships, agricultural policy initiatives should be targeted at ascertaining the sale of the farmers' products in the farmer buyer relationship. The third key finding is that increasing price certainty increases the odds of farmers participating in relationships with buyers. This suggests that farmers value an assured price, price premium, knowing price ahead of the sale, opportunity to improve the price when market conditions change,

and decreased price variability during the season. Hence policy initiatives that ascertain the farmers expected prices can promote farmers' participation in relationships. The fourth key finding suggests that farmers producing fruit crops increases the odds of participation in relationships, therefore, the fruit enterprise can be a big target of policies that promote farmer-buyer relationships.

The next 5 key findings represent the hierarchy of the farmers' relationships in terms of incremental revenue. The fifth key finding suggests that mango farmers who develop their relationships through farmer-based organizations or agents have a higher average incremental revenue. On the contrary, the sixth key finding shows that for maize and cassava farmers, developing direct relationships with the buyers yield the highest average incremental revenue. It can, therefore, be suggested that policy initiatives and advocates of farmers' relationships should target strengthing farmer-based organizations for mango farmers to enhance payoffs from relationships with buyers. However, maize and cassava farmers' policy targets should be to empower farmers to develop direct relationships with the buyers. The seventh key finding shows that mango farmers are better off when they focus their relationships with the buyers on price-quality or price-quality-quantity specifications. Hence policy initiatives that are targeted at enhancing farmers' ability to meet the price, quality and quantity specifications could as well enhance their payoffs in the relationship. The eighth key finding suggests that cassava and cocoa farmers are better off focusing their relationships on price-quality or price only specifications. Policy initiatives to enhance cassava and cocoa farmers' ability to meet price and quality specifications of buyers could enhance farmers' incremental revenues. The final key finding shows that formal agreements in relationships favor cassava farmers. Formal agreements should be promoted in cassava farmers' relationships to enhance their payoffs in the relationships.

Table 5.1: Key findings and policy implications

Key findings	Policy implications
Increasing information availability increases the odds of participating	Promote transparency between farmers and buyers in relationships
Increasing sales certainty increases the odds of participating	Support initiatives that focus on farmers being able to sell their crops in relationships
Increasing price certainty increases the odds of participating	Support initiatives that allow farmers to receive their expected prices.
Fruit enterprise increases the odds of participating	Promote relationships for farmers in the fruit enterprise
Developing relationships through FBOs or agents favors mango farmers	Strengthen mango FBOs to take advantage of relationships with buyers
Developing direct relationships with buyers favors maize and cassava farmers	Promote direct relationships with buyers for maize and cassava farmers
Mango farmers are better off focusing on price-quality or price-quality-quantity	Support initiatives that will enhance mango farmers ability to meet price, quality and quantity specifications
Cassava and cocoa farmers are better off focusing on price-quality or price	Support initiatives that will enhance cassava and cocoa farmers ability to meet price and quality specifications
Formal agreement in relationships favors cassava farmers	Support initiatives for cassava farmers to use formal agreements in their relationships

5.4. Limitations for Further Research

The developments in this research present some lessons that could be addressed for further research. The main lesson is related to the granularity of the data because of the number of different

crop enterprises. To strengthen the findings of the incremental revenues which were analyzed at the crop level, it would be beneficial to have a dataset that has a larger sample of farmers in the different crop enterprises. The motivators for farmers' participation in relationships were estimated at the farmer level and the findings indicate that transaction costs increase the probability of farmers' participation in relationships. Also producing perishable crops increases the farmers' probability of participating in relationships relative to producing durable crops. It would be interesting for further research to consider this estimation at the crop level with a larger sample to assess if and which transaction cost component affects which crops enterprises of farmers.

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Appendix A - Types of farmer relationships by crop

	Partici pants	**Structure of relationship**			**Specification of relationship**										**Governance of relationship**		
Crop	# of farmer	D2B	FBO	Agent	Price	Price only	Qual	Qual only	Qu ant	Quant only	Quant & qual	Quant & price	Qual & price	Quant, qual & price	Verba l	Wri tten	Con tract
Coconut	3	3	0	0	1	0	3	0	3	0	2	0	0	1	0	2	1
Mangoes	17	12	4	1	13	0	17	2	11	0	2	0	4	9	4	2	11
Oranges	2	2	0	0	2	0	2	0	1	0	0	0	1	1	1	0	1
Papaya	7	7	0	0	7	0	7	0	3	0	0	0	4	3	2	1	4
Pineapple	5	5	0	0	5	0	5	0	3	0	0	0	2	3	1	0	4
Beans	2	2	0	0	2	0	2	0	1	0	0	0	1	1	0	0	2
Groundnut	1	1	0	0	1	0	1	0	1	0	0	0	0	1	1	0	8
Maize	19	19	0	0	7	0	18	6	12	1	5	0	1	6	11	0	2
Oil palm	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0
Rice	9	9	0	0	9	7	2	0	1	0	0	0	1	1	7	0	0
Cassava	33	25	7	1	32	3	24	0	17	1	0	5	13	11	24	7	2
Cocoyam	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0
Plantain	8	8	0	0	4	1	4	1	5	2	1	1	1	1	7	0	1
Yam	1	1	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0
Cashew	4	2	0	2	1	0	3	2	2	0	1	1	0	0	4	0	0
Cocoa	72	40	28	4	14	10	62	53	5	0	5	0	4	0	61	3	8
Okra	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
Onion	1	1	0	0	1	0	1	0	1	0	0	0	0	1	1	0	0
Peppers	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
Tomatoes	2	2	0	0	1	0	1	1	1	0	0	1	0	0	2	0	0
Total	190	143	39	8	103	23	154	67	68	4	16	9	32	39	131	15	44

Appendix B - Summarized specifications of farmers relationships

Farmers' Characteristics	Quantity-Based		Quality-Based		Price-Based	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Farm income (GHS/m)	9,854.60	36,028.46	4,859.61	23145.86	6,622.81	27,738.11
Off-farm inc (GHS/m)	4,251.17	4,345.30	2,701.75	3279.86	3,367.29	3,713.02
Farm experience (Yrs)	18.65	9.44	21.49	10.64	20.31	10.92
Education (yrs)	10.81	4.99	10.30	4.50	10.92	5.16
Age (yrs)	47.83	12.97	50.74	11.66	49.15	13.21
Gender (1=Male)	0.87	0.34	0.77	0.42	0.82	0.38
farm size (acres)	83.48	241.86	46.45	156.94	59.92	187.24
Single crop(1=Yes)	0.38	0.49	0.39	0.49	0.41	0.49
Fruits (1=Yes)	0.42	0.50	0.29	0.45	0.36	0.48
Roots (1=Yes)	0.54	0.50	0.43	0.50	0.48[A]	0.50
Grains (1=Yes)	0.58	0.50	0.52	0.50	0.55	0.50
Nuts (1=Yes)	0.27	0.45	0.54	0.50	0.33	0.47
Vegetables (1=Yes)	0.13	0.34	0.11	0.31	0.16	0.37
N	52		132		91	