FACTORS AFFECTING ADOPTION OF ALTERNATIVE PINEAPPLE PRODUCTION SYSTEMS IN GHANA

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MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS

In the

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DECLARATION

I, Farida Badu-Gyan, hereby declare that this dissertation submitted for the degree of Master of Science in Agricultural Economics in the Faculty of Natural and Agricultural Sciences, Department of Agricultural Economics, at the University of the Free State, is my own independent work, and has not previously been submitted by me to any other university. I furthermore cede copyright of the dissertation in favour of the University of the Free State.

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DEDICATION

This dissertation is dedicated to my wonderful parents and all my siblings for their spiritual support, words of encouragement and push for tenacity throughout my education. You are greatly cherished.

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ABSTRACT

The main objective of this research was to examine farmers' decision and choice of production systems for pineapple production in order to determine the effect of factors within the social, physical and institutional environment that the farmers in the Central Region of Ghana operate under. An integrated value chain (VC)–New Institutional Economics (NIE)–Structure-Conduct-Performance (SCP) framework ('VC-NIE-SCP framework') was used to identify and describe the characteristics and requirements of the different production systems in the pineapple production sector. The integrated VC-NIE-SCP framework allows for comprehensive analysis of the behaviour and performance of small-scale pineapple farmers in their social, physical and institutional environment. A multinomial logit model was used to determine the factors that will influence farmers' decision and choice of pineapple production system in Ghana in order to assess the relationship between social, physical and institutional factors and farmers choice behaviour. The results show that there are three pineapple production systems in the Central Region, namely certified organic, non-certified organic and conventional pineapple production systems. The majority of the farmers are conventional pineapple producers. Participation by women in the pineapple sector is very low. All the categories of farmers are credit-constrained. Most of the certified organic farmers have either written or oral contracts with pineapple exporters or processors. Most of the farmers in all the three categories have basic education. The empirical results reveal that farmers' choice of certified organic pineapple production is positively influenced by the farmers' concern for the environment, organic premium perception, and contracts with certified organic pineapple exporters or processors, training on organic production, access to support services from governmental or non-governmental organisations, and availability and access to the certified organic market. Within the institutional environment, farmers' knowledge on institutional factors, such as level of knowledge on land tenure systems, level of knowledge on phytosanitary regulations of importing countries, and level of knowledge about the traditional norms, taboos and beliefs in the farming communities, all have positive influence on farmers' choice of certified organic pineapple production system. Social capital index has a positive influence on farmers' choice of certified organic pineapple production. However, personal factors, such as senior high school, training college and undergraduate university levels of education, household size, off-farm activity and wealth of farmers, have negative influence on farmers' choice of certified organic pineapple production. Farmers' choice of certified organic pineapple production is negatively influenced by access to government-subsidised inputs. Among the physical environment factors, farm size and distance from farm to organic market negatively influence farmers' choice of certified organic pineapple production,

compared with conventional production methods. Owned land tenure system has a negative influence on farmers' choice of certified organic pineapple production, compared to conventional production methods. The main conclusion from this research is that, for the growth and development of the certified organic pineapple production sector in Ghana, policy makers should take the above factors into consideration when designing policy documents and sustainability strategies for the development of the pineapple sector.

Key Words: Ghana, pineapple, production system, certified organic, multinomial logit, social environment, physical environment, institutional environment

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ABF	Attitudinal and Behavioural Factors
CUC	Union certification
EFEG	Exotic Fruit Exporters Association
EFID	Export Development and Investment Fund
EU	European Union
FAGE	Federation of Association of Ghanaian Exporters
FAO	Food and Agriculture Organisation
FiBL	Forschungsinstitut für biologischen Landbau
FPI	Finance Perception Index
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GEPA	Ghana Export Promotion Authority
GIZ	Germany Technical Corporation
GLOBALGAP	Global Good Agricultural Practices
GLSS	Ghana Living Standard Survey
GSB	Ghana Standards Board
HAG	Horticultural Association Ghana
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements
IMO	Institute of Market Ecology
IF	Institutional Factors
IPI	Institutional Perception Index
ITFC	Integrated Tamale Fruit Company
KEEA	Komenda Edina Eguafo Abirem
KMO	Kaiser-Meyer-Olkin
MoFA	Ministry of Food and Agriculture
NGOs	Non-governmental organisations
NIE	New Institutional Economics
NTAE	Non-Traditional Agricultural Export
ODI	Overseas Development Institute
OFPI	Overall Financial Perception Index
OIPI	Overall Institutional Perception Index
PAMPEAG	Papaya and Mango Producers and Exporters

PC	Personal Characteristics
PF	Physical Factors
PHC	Population and Housing Census
PPRSD	Plant Protection and Regulatory Services
PRA	Participatory Rural Appraisal
SCP	Structure Conduct Performance
SF	Social Factors
SPEG	Sea Freight Pineapple Exporters of Ghana
SRID	Statistics, Research, Information Directorate
UNCTAD	United Nations Conference on Trade and Development
USAID	United State Agency for International Development
VC	Value Chain
VC-NIE-SCP	Value Chain New Institutional Economic Structure Conduct Performance
WDI	World Development Indicators
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

The food and agricultural sector is an important sector of the Ghanaian economy, because of its contribution to sustaining growth and reducing poverty. The contribution of agriculture to growth is through its contribution to Gross Domestic Product (GDP) and improvement in livelihood of most Ghanaians (Asante & Ntow, 2009; Owusu-Boateng & Amuzu, 2013). In terms of livelihood contribution, the sector contributes largely towards meeting food needs, and provides employment opportunities and income to over 50 % of the Ghanaian working population, especially in rural areas (Diao, 2010; World Development Indicators (WDI), 2011). The contributions have led to the agriculture sector holding a central role in the developmental strategy of Ghana. Agricultural policies formed since 2002 are intended to contribute to economic growth and development by improving access to market and financial services, improving infrastructure, enhancing human resources and institutional capacity, and reducing unsustainable management of land (MoFA, 2002).

Governmental agencies, non-governmental organisations (NGOs), international bodies and donor agencies have implemented and promoted organic production and its component techniques as a rural developmental tool for improving the productivity of small-scale farmers, addressing food insecurity, and increasing farmers' income and their livelihood as a whole (Parrott, Olesen & Høgh-Jensen, 2006). Specifically, certified organic pineapple production is one of the strategies that has received much attention among the non-traditional export crops in Ghana. This is because certified organic pineapple has high demand in the export and domestic markets (Kleemann, 2012; Adebiyi, 2014). Secondly, the promotion of certified organic pineapple production will also enable farmers to integrate into the competitive niche market, which will improve the livelihood conditions of smallholder farmers through export earnings and price premiums (Adebiyi, 2014).

Evidence from research in Ghana has also proved that certified organic pineapple production is more profitable than conventional pineapple production, maximise cost-effectiveness and

will reorient agricultural commodities towards areas of market demand (Kleemann, 2011; Apinga, 2011; Owusu and Anifori, 2013). Recent research by Kleemann, Abdulai & Buss (2014) in Ghana revealed that, on average, a farmer cultivating one acre of certified organic pineapples obtains a profit of GH¢ 1 710, whereas the conventional farmer obtains a profit of GH¢ 780 per acre. This indicates that the certified organic pineapple farmer obtains GH¢ 930 more profit than the conventional farmer. Also, a survey by USAID (2012) in Ghana, revealed that margins for smallholder organic certified pineapple producers, linked to the fresh pineapple market, were quite high, ranging from US$1 369[1] to US$5 522 a year, with an average gross margin of US$1 800 in a normal production year. Gross margins in the range of US$1 800 per acre and higher were indicated as high enough, and likely sufficient, for a smallholder pineapple farmer to emerge from poverty, even with only one acre of certified organic pineapple production.

Furthermore, the predominance of a traditional pineapple production system which is similar to organic production practices was expected to make it easy for conversion to certified organic production (International Fund for Agricultural Development (IFAD), 2003; United Nations Conference on Trade and Development (UNCTAD), 2003). This, among other things, motivated stakeholders to promote certified organic pineapple production as a rural developmental strategy. However, farmers are not converting to certified organic pineapple production, despite the importance associated with it. It is unfortunate that the formal organic sector currently occupies only a small fraction (0.2 %) of agricultural land, which includes the land area under certified organic production. The rate of growth of land area under certified organic production, which includes the certified organic pineapple production system, has been slow over the years (IFOAM & FiBL, 2014). For instance, the rate of growth of land area under certified organic production increased by 71.5 % from 2003 to 2006, but reduced by 28.23 % from 2006 to 2008. The rate of growth has continued to reduce, by 5.34 % from 2008 to 2012, indicating that the number of farmers converting to certified organic production is decreasing (IFOAM & FiBL, 2014). Michelsen, Lynggaard, Padel & Foster (2001) have stated that the growth of certified organic farming is based on the cumulative impact of the decisions of individual farmers to adopt certified organic farming.

To increase the adoption of certified organic production, individual farmers must be willing to convert. The willingness of the farmer to convert to certified organic production can only be determined at the end of the farmer's decision-making process. During the choice of production system, several factors which vary in relative importance, depending on the

1 Average exchange rate for January, 2012: 1US$= 1.6076GH¢. Source: Bank of Ghana, 2012.

farmer's objectives, are weighed. According to Kleemann (2012), the environmental situation of the community or region (e.g. information systems in the area, farmer networks and cultural proximity to traditional agriculture) where certified organic production is being promoted may affect the development of the organic sector in Ghana. Thus, it is obvious there are some unknown factors that may prevent farmers from choosing a certified organic pineapple production system from among the other production systems in Ghana. For example, rural poor communities in Ghana experience circumstances, such as difficulties in acquiring land, weak producer organisations, inadequate extension staff, poor infrastructure and lack of access to credit and markets, that may influence smallholder farmers' choice of adopting a certified organic production system (MoFA, 2007).

Despite the clear benefits and the effort from stakeholders to encourage and disseminate the use of certified organic production as a tool for improving small-scale farmers' livelihood, statistics indicate that a small fraction (0.2 %) of agricultural land is under certified organic production. The proportion of agricultural land under certified organic production is not the only concerning issue; the growth rate of the land under organic production is slow. This implies that farmers are converting or adopting certified organic pineapple production at a slow rate. As a result, the potential of certified organic production, as a rural developmental tool to improve farmers' livelihood in Ghana, is yet to be optimised. Uncertainty exists regarding the important factors that explain why farmers do, or do not, choose certified organic production systems.

1.2 The Problem Statement

Although the characteristics of the environment that the farmers are embedded in are recognised to influence farmers' behaviour, there is lack of understanding of the social, physical and institutional environment in which the pineapple farmers operate. This has resulted in stakeholders promoting and making recommendations to increase the adoption of certified organic pineapple production without considering the existing incentive structure that caused the current behaviour choice of farmers. Furthermore, the extent to which factors within the social, physical and institutional environment contribute to the slow adoption of certified organic pineapple production system remains uncertain.

Various researchers in developed countries, and a few in developing countries, have endeavoured to conduct research on the importance of different factors influencing farmers' decisions to adopt certified organic production (Dabbert, Häring & Zanoli*,* 2004; Flaten, Lien, Ebbesvik, Koesling, & Valle , 2006; Lohr & Salomonsson, 2000; Offermann, Nieberg & Zander,

2009; Padel, 2001; Pietola & Oude-Lansink, 2001; Schneeberger, Darnhofer & Eder, 2002; De Cock, 2005; Best, 2010; Cranfield, Henson & Holliday, 2010; Koesling, Flaten, & Lien, 2008; Läpple, 2010; Padel, 2001; Hattam & Holloway, 2005; Kisaka-Lwayo, 2008; Pastor, Legaspi, Agbigay, Pastor, Salas, Cacatian & De Padua, 2011; Saker, Itohara & Hoque, 2010; Svotwa, Baipai & Jiyane, 2009; Tran, 2009; Kleemann, 2012). These numerous research studies have focused more on developed countries, with little consideration given to sub-Saharan Africa, and Ghana in particular.

Many of the elaborated factors emerging from the research undertaken in developed countries only apply to those countries because the conditions favouring conversion to certified organic production in those countries are very different from those in developing countries. Especially relevant, with regard to the policy environment and in particular subsidies for conversion to certified organic production, are access to markets, a strong domestic demand for organic products, farmers' financial resources, appropriate training facilities, access to extension services, and attitude towards social, health and environment (Thamaga-Chitja & Hendriks, 2008). The few studies done in developing countries have only focused on farmers' personal characteristics and attitudes, motives and farm characteristics as being important determinants of conversion to certified organic production. The researchers did not consider the factors pertaining to the social and institutional environment of small-scale farmers in developing countries which influence the farmers' decision. The recommendations that were made arising from research, and the suggestions of factors to overcome hindrances, have therefore not been applicable to avert or improve the unfavourable situation of the certified organic production system in Ghana. This suggests that there are still unknown factors that need to be identified in order to improve upon the adoption of certified organic pineapple production in Ghana. Moreover, Jordaan (2012) has stated that the social, physical and institutional environment that small-scale farmers are embedded and operate in influence a farmer's behaviour in terms of making managerial decisions.

A value chain analysis by Kleemann (2011) to calculate the profitability of certified organic pineapple production stated that land tenure and security, collective organisations, physical infrastructure, contract security and institutional framework are important factors that might make certified organic pineapple production a viable option for small-scale farmers in Ghana. This confirms that drivers within the small-scale farmers' environment in Ghana may influence the farmers' behaviour, and as such, its influence on farmers should be researched. The few studies done on certified organic production system in Ghana (e.g. Danso, Drechsel & Fialor, 2002; Kleemann, 2011; Apinga, 2011; Kleemann & Abdulai, 2012) did not focus on identifying the factors that influence pineapple farmers' choice of production systems in Ghana. None of

these studies in Ghana has considered the effect of factors within the social, physical and institutional environment that operate on the behaviour choice of small-scale pineapple farmers. Thus, the influence of these factors on pineapple producers' choice of production systems is unknown. Therefore, the study seeks to determine the effects which the social, physical and institutional environment, within which the small-scale pineapple producers operate, have on their choice of a particular production system.

1.3 Research Objectives

The main objective is to examine the decisions and choices of production systems by farmers for pineapple production in order to determine the effect of factors within the social, physical and institutional environment that the farmers operate. The determined factors will contribute to improving small-scale farmers' livelihood by informing government and other key players along the pineapple value chain with respect to the characteristics and factors to strive for, when promoting certified organic pineapple production.

The main objective will be reached through the attainment of the following specific objectives:

1) To identify and describe the characteristics and requirements of the different production systems in the pineapple production sector by using the integrated VC-NIE-SCP framework in order to obtain a better understanding of pineapple production and marketing, with respect to the social, physical and institutional environment.
2) To determine the factors that will influence farmers' decisions and choices of pineapple production system in Ghana in order to assess the relationship between social, physical and institutional factors and farmers behaviour choice.

1.4 Organisation of the Study

The remainder of this dissertation is organised as follows. An overview of the relevant literature on production systems and factors influencing the choice of production system are provided in **Chapter 2**. Included in Chapter 2 is an introduction on production systems, background, and characteristics of conventional and organic production systems. The chapter further discusses factors that will influence farmers' choice of production system and the approaches used for analysing the factors and the conclusions. **Chapter 3** consists of two sections. The first section involves the description of the data, which includes a description of the study area, of how the questionnaire was developed, and of the sampling approach used in the study. Also included in this section are the characteristics of the respondents. The second section

describes the procedures employed in analysing the specific objectives of the study. **Chapter 4** gives a presentation and discussion of the results obtained. The dissertation is concluded in **Chapter 4**, which presents a summary of the study, final conclusions made from the study, some recommendations for future research, and recommendations for contributions by policy makers and key stakeholders in promoting certified organic pineapple production.

CHAPTER 2

LITERATURE REVIEW

The chapter consists of five main sections. The first section discusses the Ghanaian pineapple sector. A review of literature on the various pineapple production systems which comprise of the organic and conventional production systems is presented in Section 2. The organic production system is categorised into certified organic and non-certified organic production. Also presented in this section is an overview of organic production and marketing in Ghana. The third section reviews empirical literature on factors influencing farmers' choice of certified organic production system from among other production systems. Methods of estimating factors which influence the choice of production systems and the respective components of the integrated value chain and new institutional economics (NIE) – structure-conduct-performance (SCP) framework are discussed in the fourth section. The conclusion of the chapter is provided in the last section

2.1 The Pineapple Sector in Ghana

2.1.1 The Importance and Development of the Pineapple Industry

Pineapple is a strategic crop that has been used by the government of Ghana for rural development for more than a decade. Pineapple was the first non-traditional export (NTAEs) crop that Ghana produced in the 1980s. In the 1980s, the country was in a midst of the most severe economic crisis and decided to promote commercial pineapple production as an NTAEs crop. As a result of a successful promotion, the contemporary pineapple industry started in the 1980s. Ghana began exporting pineapple, albeit in small quantities, to Europe at the end of the 1980s (Danielou & Ravry, 2005).

The industry was made up of smallholder producers until the early 1990s, after which the government of Ghana implemented policies and programmes that led to the expansion of the industry. Large-scale commercial producers,[2] both local and international, took advantage of the favourable policies, and of support from government and donor agencies, to vertically integrate into production (Takane, 2004; Fold & Gough, 2008). The entry of large companies,

2 Commercial producers are pineapple farmers cultivating for the export market.

the market positioning of the country's pineapple export, and the comparatively low airfreight cost advantage during export were factors that accounted for the industry becoming even stronger and more productive (Danielou & Ravry, 2005; Jaeger, 2008). Figure 2.1 below shows the volumes and value of pineapple exports from Ghana from 1987 to 2013.

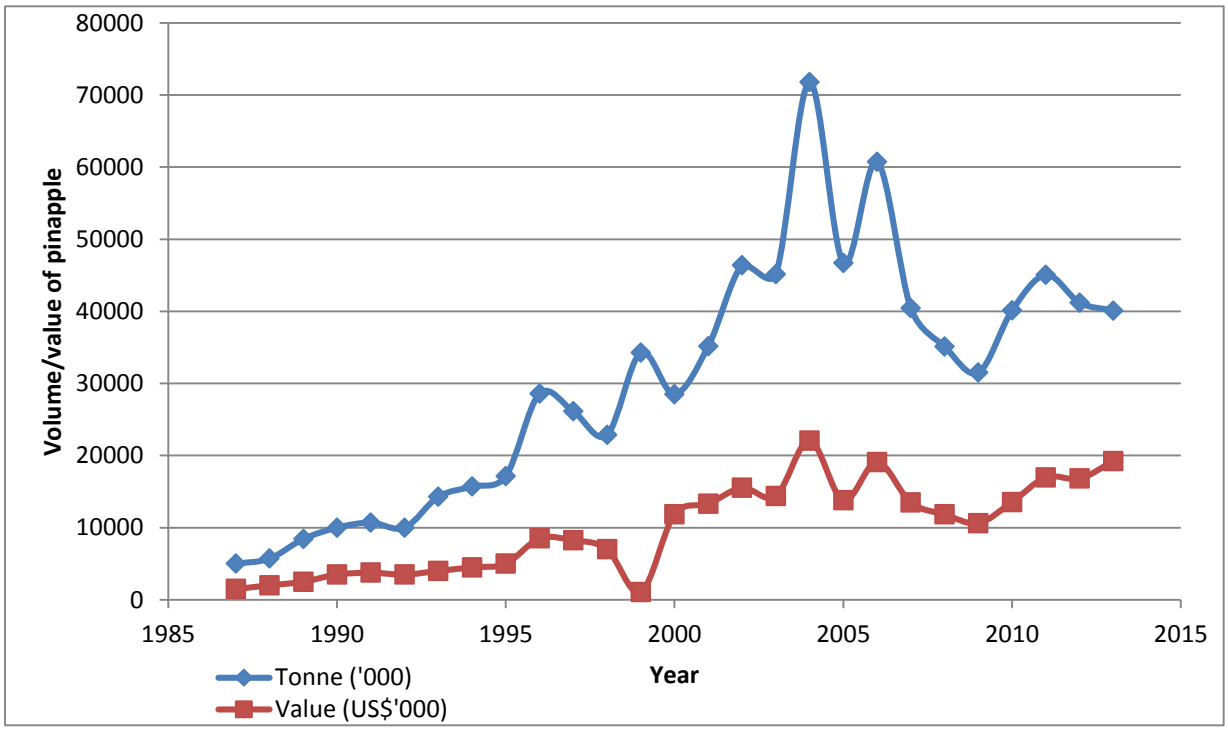

Figure 2.1: Volumes and Value of Pineapple Export from Ghana 1987-2013
Source: Ghana Export Promotion Authority (GEPA) (2014)

As shown in Figure 2.1, the volumes of pineapple exported to the European Union (EU) market increased to 71 805 tonnes in 2004, capturing 10 % of EU market share for pineapples (Overseas Development Institute(ODI), 2011). Ghana became one of the top suppliers of pineapple to the EU market, along with Côte d'Ivoire and Costa Rica (Achaw, 2010). Unfortunately, the volumes of pineapple exports started declining after 2004, caused by factors which are related to productivity. Some of the factors include changes in variety, the European market after the introduction of a new pineapple variety called MD2 by Costa Rican companies, and the rising concern for certification of pineapples to ensure the use of Good Agricultural Practices (GAP) for production.

The impact on the industry of the introduction of the new variety became more significant after 2004 when European consumers regarded the MD2 variety as better than the smooth cayenne (the widely grown and exported variety from Ghana). The MD2 variety virtually eliminated

supermarket shelf space for all other pineapple varieties in the European Union market, including the smooth cayenne (Achaw, 2010). While farmers were trying to adopt and switch to MD2, the industry encountered another obstacle in the form of high ethephon (a synthetic plant-growth regulator) residual levels in Ghanaian pineapples on the market in 2001. The situation brought the entire industry into a public disrepute, which led to the need for EUREPGAP (now GLOBALGAP) certification, required for gaining access to the European Union market (Gogoe, 2004). Both obstacles affected most farmers in the industry, especially the small-scale farmers with limited capital. The reason is that the MD2 pineapple variety requires substantial capital investment (Takane, 2004). The GLOBALGAP certification requires farmers to respond to increasingly stringent market requirements, which are very tasking and expensive (Takane, 2004; Jaeger, 2008). Therefore, some smallholder pineapple farmers stopped pineapple production because of the stringent market requirements and expensive certification (Jaeger, 2008; Zakari, 2012). The other smallholders that continued to grow smooth cayenne had their markets reduced to supplies to processors. The number of exporters reduced from 42 to 8 and the volume of pineapple exports fell by 39 % from 2004 to 2005 (ODI, 2011; Zakari, 2012).

The reduction in market share and its impact on small-scale farmers' livelihood stimulated the government to fund and support programmes that help re-establish the country's place as one of the world's leading exporters of pineapple. The various programmes include providing support for farmer groups, financing research projects, and launching an MD2 multiplication programme through a partnership with the World Bank (Achaw, 2010). The integration of smallholder farmers into competitive markets was the main focus of agricultural policies. Donor agencies, NGOs and professional agencies have also supported smallholders to shift to the MD2 variety and attain certification (Fold, 2008). The Ghana Export Promotion Authority (GEPA) has indicated that the support from various agencies has revitalised the industry.

The industry's export volume has increased again, with over 95 % of the total pineapple exported in 2008 being the MD2 variety (Achaw, 2010). Despite the known challenges which have undermined the industry's competitiveness, pineapple is still the single most important and lucrative NTAEs crop. This makes the crop a good choice for the study because the crop is strategic, given its potential to contribute towards the national export drive, foreign exchange earnings and poverty alleviation, especially for smallholder producers. Moreover, the industry is focused on enforcing GAP for production and a certification system that also protects the environment from unsustainable practices.

2.1.2 Pineapple Production and Marketing in Ghana

Pineapple is cultivated by a large number of rural and urban households. According to the Ghana Living Standards Survey conducted in 2008, 2 % of households in Ghana cultivate pineapple on both subsistence and commercial bases (GSS, 2008). In 2010, 10 000 ha were cultivated with pineapple (Statistics, Research and Information Directorate (SRID), 2011). The main pineapple varieties cultivated in Ghana are the sugarloaf, smooth cayenne and MD2 varieties. A total of 120 000 tons to 150 000 tons of pineapples are produced in Ghana annually (Kleemann, 2011). Large and medium farm holdings account for about 70 % of production, with the remaining being produced by smallholders. Production on larger farms is known to be more input intensive, whereas production on small farms often practise extensive cropping systems, with long fallow periods of up to ten years, and with limited access to farm inputs, mechanical equipment and training (Amoako, 2010; Ninson, 2012; Kleemann, 2012).

Producers of fresh pineapples can be classified into four categories, namely small-scale producers, out-growers, large/medium-scale commercial producers or exporters (including local and transnational companies), and international agribusiness corporations (Achaw, 2010). Small-scale producers and out-growers both cultivate from 1 acre[3] to 20 acres of land, but are still distinguished in Ghana based on their relationship with large pineapple companies or exporters (Danielou & Ravry, 2005). Out-growers have been contracted (formal contract) by private large-scale companies/exporters or processing firms to furnish a regular supply of pineapples (Danielou & Ravry, 2005; Fold & Gough, 2008). The out-growers sell their produce to their contractors and the contractors in return provide various forms of support to the out-growers, including advances of the out-growers' inputs in the form of seeds, chemicals, cash and technical support. However, upon receipt of the fruits, the company pays the out-grower, deducting the costs associated with the inputs (Danielou & Ravry, 2005). Small-scale producers have no formal relationship (i.e. without contracts) with the companies or exporters, but some large-scale export companies purchase from smallholders (on spot markets) to supplement their requirements (Fold & Gough, 2008). The use of external purchases acts as an alternative to full vertical integration which enables large companies or exporters with own plantations to decrease various risks, for example unexpected EU demand fluctuation (Suzuki, Jarvis & Sexton, 2008; Coates, Kitchen, Kebbell, Vignon, Guillemain, & Hofmeister, 2011).

Large/medium scale companies and international corporations operate at different stages of the value chain; some are producers, others are processors and exporters. Some players

3 1 Hectare = 2.47 Acres.

often manage to integrate all these activities into their operations (Danielou & Ravry, 2005). The companies are either established by local entrepreneurs or through joint ventures with British, Lebanese, and Dutch partners. According to Kleemann (2011), there are situations where some exporters are also producers for a fraction of their export. The pineapples produced by these categories of farmers are absorbed into two markets, which are the export and the local markets. Pineapple products for the export markets are certified to meet general standards, such as GLOBALGAP and organic. The main export market for pineapples from Ghana comprises the EU consumers, with main destination countries being Belgium, Switzerland, the Netherlands, Germany, the United Kingdom, Italy and France (Danielou & Ravry, 2005; Kleemann, 2011). The export markets include fair trade and organic niche markets. Whole pineapples, as well as processed fruit segments, are distributed to large supermarkets, specialty shops and wholesalers in the export market (Coates *et al*., 2011). An estimated 30 % of the 63 % of pineapple exported from Ghana between 2003 and 2007 comprised processed products (juice, dried, and fresh-cut), while the remaining portion was exported as fresh pineapple (Kleemann, 2011). This indicates that a high proportion of Ghana's pineapple exports are in unprocessed form.

In addition to the export market, a sizeable domestic market for pineapples exists in Ghana. The domestic market absorbs a large quantity of pineapples when there is an excess supply or when the produce does not meet export quality (Takane, 2004). There are two main supply channels on the domestic market, namely the processors and middlemen. A number of processing companies process pineapple into fresh cut, fruit salad, dried pineapple and juice for export markets and urban consumers at the local market. Ghana's pineapple processing capacity is currently estimated to be over 35 000 mt/year (Kleemann, 2012). Fresh pineapples are traded through a network of wholesalers and retailers, also known as middlemen. Middlemen then make the fresh pineapple readily available on roadsides and in local open markets. Middlemen take on risks associated with storage, transport and related finance (Coates *et al*., 2011). Middlemen sometimes provide some technical support to farmers to meet certain standards of produce.

Due to the importance of the industry, several research and professional institutions in the supply chain provide support for pineapple production in Ghana. The institutions include GEPA, which facilitates the development and promotion of export, and the Export Development and Investment Fund (EFID), which provides financial resources for the development and promotion of Ghanaian export. Some exporter associations, such as the Sea Freight Pineapple Exporters of Ghana (SPEG), the Horticultural Association Ghana (HAG), and the Exotic Fruit Exporters Association (EFEG), also work to promote Ghanaian

exporters in providing services to the growing European fresh pineapple produce market. The Ministry of Food and Agriculture (MoFA) also provides some support, which includes the construction of post-harvest infrastructure, MD2 sourcing and development, setting up a crop geographic database, food safety and quality management, and industry ownership models. The category of pineapple farmers that receives much support are the small-scale farmers. Small-scale farmers are supported by donors and non-governmental organisations because they are assumed to be the weakest part of the chain and the one with the highest potential of poverty impact.

Pineapple is a strategic crop with significant contribution to the economy of Ghana. The promotion of pineapple production and export has been effective in improving the income of rural poor farmers and reducing poverty, despite the challenges faced by the industry over the years. Next, the focus of attention shifts to discussion of various production systems that can be used for pineapple production.

2.2 Production Systems

An agricultural production system has been defined by Haines (1982) as a food production system. A number of studies conducted on production systems for producing food in agriculture have described the various production systems as managerial ways or approaches for farming (Ricker, 1997; Poudela, Horwathb, Laninic, Templed & van Bruggen, 2002; Hathaway-Jenkins, Godwin, Pearce, Sakrabani & Whitmore, 2010; Cranfield *et al.,* 2010; Läpple & Kelley, 2010; Assis & Mohd, 2011). As a result of these two descriptions, production systems can be defined in agriculture as being an umbrella term representing the various production or management approaches for tending plants and animals, as well as manipulating the farming environment. Various farm management approaches for farming have been developed and adopted by farmers over time. These include conventional, organic or biological (Reeve, 1990; Lampkin, 1992), bio-dynamic, and permaculture production systems (Beus & Dunlap 1990; Chambers & Conway 1991; Heimler, Vignolini, Arfaioli, Isolani & Romani, 2011). Conventional production is the dominating system used by farmers after the green revolutionary era and has become the mainstream agricultural system (Pattanapant & Shivakoti, 2009). The various production systems that have emerged after the conventional production system are termed alternative production systems. For the purpose of this study, only the conventional and organic production systems are discussed. A background of organic and conventional production systems are discussed in the next section.

2.2.1 Organic Production System

An organic production system is a method of production that is based on its input supply, the agricultural management practices used, and its integrated system (Wallace, 2001). As defined by the Food and Agriculture Organisation (FAO)/World Health Organisation (WHO) Codex Alimentarius Commission (1999), an organic production system is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. Organic agriculture emphasises the use of management practices in preference to the use of off-farm inputs, taking into account the point that regional conditions require locally adapted systems (FAO, 1999). The official definitions of organic production system focus heavily on what is not included (i.e. agrochemicals) in organic production. As such, it remains a management system relative to conventional production, rendering it subject to the same comparative scales as conventional methods. Farming organically requires farmers to use organic inputs and exclude the use of synthetically produced agro-inputs, like compound fertiliser, pesticides, growth regulators, antibiotics and genetically modified organisms, for all farm activities, such as maintaining soil productivity, weed control and pest management (IFOAM, 2004; Khaledi, 2007).

The organic production system can be categorised into two categories, namely non-certified organic production systems and certified organic production systems. Non-certified organic production, according to FAO (2009), refers to organic production practices conducted by intent and not by default; farm production systems that are intentionally and voluntarily carried out to fulfil the requirements of organic production, but which are not certified organic, are referred to as non-certified organic production systems. Certified organic production refers to the type of organic production system and product that has been managed and produced in accordance with specific standards or technical regulations and has been inspected and approved by a certification body (FAO, 2009).

A certified organic production system is based on a set of prescribed guidelines or rules that are designed to be applied or adopted as a whole package. The rules and regulations have been laid down by governmental, non-governmental and grassroots organisations that promote and encourage organic production. For instance, IFOAM, a worldwide umbrella organisation for the organic agriculture movement, has set down important internationally accepted standards. The accepted standards comprise rules on cultivation, pest, weed control and animal husbandry for organic production which serve as a guide to the producer (IFOAM, 2011). The application of these rules is monitored by certification bodies. Certified organic production is the final stage of the adoption of organic agriculture.

The study focuses on the certified organic production system because it is the main system which is being promoted in Ghana and also due to the following benefits. The benefits are grouped into two broad categories; economic and non-economic benefits. The economic benefits provided by certified organic production relate largely to cost impact, market access, price premiums and improved net returns (Cranfield *et al.,* 2010; Kleemann *et al.,* 2014). Certified organic production reduces some aspects of costs related to high input usage, such as chemical fertilisers and pesticides which account for a larger part of farm expenditure, thereby reducing cost of production (Owusu-Boateng & Amuzu, 2013). The reduction in costs of production can lead to increases in returns or profits, ceteris paribus. As a result of the reduced expenditure on inputs, certified organic production reduces financial risk. Financial risk in organic production is reduced by avoiding or reducing the need for credit (often at high interest rates) to purchase inputs (Diao, 2010).

Certified organic production allows farmers to obtain access to the fastest growing sector of the international and local food market and obtain a premium for their produce (FAO, 2002). According to Kleemann (2011) and Apinga (2011), the price premium received in organic farming assists the farmer to offset the potential lower yields and higher labour cost that might occur in some organic farms during conversion. Due to the price premium, organic farming has favourable returns in comparison with conventional farming. Thus, the economic benefits as such reduce the need to purchase inputs, and the availability of premiums contribute to higher income and profitability, more than in a conventional production system (Hanson, 2003; Pacini, Wossink, Giesen, Vazzana & Huirne, 2003; Setboonsarng, Leung & Cai, 2005; Carambas, 2005).

There is significant improvement in the livelihood of certified organic farmers, which in the long run assists them to emerge from poverty. This is the result of the increase in income and profitability that the certified organic farmers enjoy (USAID, 2012). The organic production system is widely recognised as a means of increasing food security, especially in the rain-fed agricultural systems which are predominant in most African countries (IFOAM, 2003). The increase in income and profitability will enhance purchasing power, helping to prevent farmers from encountering problems in terms of gaining access to other food commodities (Pattanapant & Shivakoti, 2009), which will increase food security.

Certified organic production provides non-economic benefits. These non-economic benefits are related to environment, health, safety and social benefits. The environmental benefits of organic production includes reduction in soil and water pollution caused by chemical inputs, enhancement in soil fertility and structure, biodiversity of the farmlands and surrounding areas,

and conserving energy (Cormack, 2000; Stolze, Piorr, Ha¨ring & Dabbert, 2000; Reddy, 2010). Rigby & Ca´ceres (2001) have asserted that, in terms of soil, organic production system tends to conserve soil fertility and system stability. The conservation of soil assists farmers to increase the humus content of the soil, which will in turn improve the physical properties of the soil and support the life of micro-organisms. The conservation of soil contributes to sustainable environment and food production systems (Azadi, Schoonbeek, Mahmoudi, Derudder, De Maeyer, & Witlox, 2011).

The health and safety benefits provided by an organic production system relate to nutrition, quality, and producer and worker exposure to chemical residues in food products (Ministry of Agriculture and Fisheries (MAF), 1994; Heaton, 2001; Worthington, 2001). Producers are at higher risk of suffering acute and chronic bad health effects associated with pesticides and other synthetic chemicals due to occupational exposure. Evidence of health problems resulting from the accumulation of toxic compounds in human tissue of farmers, such as headache, fever, blurred vision, pesticide poisoning and cases of death, have been reported around the world, particularly in developing countries (Clarke, Levy, Spurgeon & Calvert, 1997; Tariq, Afzal, Hussain & Sultana, 2007). The intensive use of chemicals has also resulted in residual levels in agricultural commodities exceeding the maximum residue limit for consumption in countries like Ghana, which threatens public health (Asante & Ntow, 2009). An organic production system has health and safety benefits attributable to its reduction in agrochemicals usage in farming activities. An organic production system also reduces the health risk faced by consumers from contamination by agricultural commodities from chemical residue (Pattanapant & Shivakoti, 2009).

Organic agriculture creates and improves employment opportunities, especially for women in rural communities, since it is more labour-intensive and requires more hands to do the work (Midmore, 1994; MAF, 1994). Additionally, most of the middlemen involved in the marketing of organic pineapples in the domestic niche market are women who trade in pineapple for a living in most developing countries (Bateman, 1994; Farnworth & Hutchings, 2009; Cranfield *et al.,* 2010).

2.2.1.1 Overview of Organic Production and Marketing in Ghana

There is a revival of interest in the use of an organic production system as an alternative to conventional agriculture in Ghana for more than a decade. This interest has arisen owing to the profitability, cost-effectiveness and potential of organic production to reduce poverty among smallholder farmers in Ghana (Kleemann, 2011; Apinga, 2011). The formal organic

sector in Ghana can be grouped into certified and non-certified organic production systems (Osei-Asare, 2009; Parrott, Ssekyewa, Makunike & Ntambi, 2006). Before the introduction of the formal organic sector, most small-scale farmers practised the traditional method of farming through economic compulsion (Balamatti, 2000; Osei-Asare, 2009). This form of production is deemed organic by default because it involves no synthetic fertiliser and pesticide usage. The use of organic practices enables them to avoid the use of expensive agrochemicals and helps to reduce the cost of production. However, this form of farming is not defined, nor is it proven that it adequately reflects the situation of certified organic production, despite the fact that it can easily be converted to a certified organic system (Osei-Asare, 2009; IFOAM & FiBL, 2014).

The land area under certified organic production was estimated to be about 28 161 ha, as at 2012. This accounts for 0.2 % of the total land area under agricultural production in Ghana (IFOAM & FiBL, 2014). The estimated land area under organic production in Ghana has been increasing over the past decade. It increased from 5 453 ha in 2003 to 19 132 ha in 2006 (71.5 %), from 26 657 ha in 2008 to 28 161 ha (5.34 %) in 2012 (IFOAM & FiBL, 2006; 2008; 2012). The main crops grown under the organic production system are fresh fruits, such as bananas, pineapple, papaya, mango, pear and watermelon; and cash crops, such as oil palm, cocoa, cashew, cotton and shea butter, culinary herbs, cereals and vegetables (IFOAM, 2003). Four categories of farmers can be found in the organic sector: large-scale (> 2 ha), with or without out-growers system, and who are mostly expatriate-funded and managed; small- (< 2 ha) to medium-scale farmers or exporters, who are mostly local entrepreneurs and are sometimes operate with funding from external sources; other small-scale farmers growing produce for exporters; and farmers who grow crops organically for the domestic markets (Osei-Asare, 2009). Certified organic production is mostly geared to products, especially non-traditional export commodities, destined for export beyond Ghana's shores.

Export of organic products is conducted by farmer group associations; by marketing associations, such as SPEG, HAG, Vegetable Producers and Export Association, Federation of Association of Ghanaian Exporters (FAGE), the Papaya and Mango Producers and Exporters (PAMPEAG); and by individual private companies that have contract agreements with farmers, such as Integrated Tamale Fruit Company (ITFC), Blue Skies, and WAD African Food. Over 28 % of the certified organic producers export their produce, and the remaining 72 % market their produce domestically (Osei-Asare, 2009). Products sold on the domestic market are sold through direct markets, farmer markets, processors, restaurants, and mostly to retailers in the country by individual farmers. The farm gate is a major source of organic produce for the marketers. Others buy from wholesalers and very few rely on identified organic

brokers (Osei-Asare, 2009). Market research on organic products has indicated a high demand for organic products on the domestic market (Osei-Asare, 2009; Owusu & Anifori, 2012; Acheampong, Braimah, Ankomah-Danso & Mochiah, 2012).

There are no laws, regulations or policies supporting the production of organic products in Ghana. Neither is there any national organic standards and certification body. However, there is in existence a code of ethics required in the practices of organic production by the Ghana Standards Board (GSB), although this is not well known among the organic producers (Osei-Asare, 2009). The certified organic farms are, therefore, certified based on international standards and regulations, and mainly by private foreign agencies, such as the Institute of Market Ecology (IMO), Agro Eco, Control Union Certification (CUC), Ecocert, Soil Association Certification Limited, and SGS certification. In 1997, an umbrella organisation of 15 Ghanaian NGOs, known as Ecotrade, was set up with the aim of promoting ecological and fair trade principles. Other established actors, such as the Ghanaian Board of Small Scale Industries and The National Standards Board, subsequently joined this grouping which placed the development of Standards and certification high on its agenda.

Several organisations support the organic production sector in Ghana. The form of organisational structure supporting the organic system in Ghana falls under three main categories. These include: farmers that have been organised by a company which provides the farmers with support; farmers operating under NGO initiatives; and farmers who have formed their own organisations like cooperatives, associations and self-help groups. Apart from these three main categories, the sector also receives support from other governmental and NGOs in Ghana (Kleemann & Abdulai, 2012). The various organisations provide support in the form of consultancy, skills development training and programmes, infrastructure and consumer awareness building, input supply, financial assistance, information on standards and certification, and marketing links and development. The alternative method for organic farming is conventional and the following section describes it.

2.2.2 Conventional production system

A conventional production system is defined as a high-input farming method that relies on high external-energy-inputs and technologies to increase productivity. It involves the use of synthetic farm-inputs, such as fertilisers, pesticides, hormones and antibiotics (Connor, 2008; Gianessi, 2009). Knorr & Watkins (1984) have also defined conventional production systems as comprising capital-intensive, large-scale, and highly mechanised agriculture, with

monocultures of crops and extensive use of artificial fertilisers, herbicides and pesticides, together with intensive animal husbandry.

A conventional production system has certain characteristics which include rapid technological innovation; large capital investments in order to apply production and management technology; large-scale farms; single crops/row crops grown continuously over many seasons; uniform high-yield hybrid crops; extensive use of pesticides, fertilisers, and external energy inputs; high labour efficiency; and dependency on agribusiness (Asante & Ntow 2009). With conventional farming, it is possible to produce much larger quantities of food, on smaller land areas and with less input of (some) resources and labour (Gianessi, 2009). However, recent consumers' interest in natural products and the awareness of the possible health implications associated with conventionally grown food products have resulted in high demand for organic products. Potential health hazards associated with conventional production are tied to sub-therapeutic use of antibiotics in animal production, and pesticide and nitrate contamination of water and food. Farm workers are poisoned in fields, toxic residues are found in foods, and certain human and animal diseases have developed resistance to currently used antibiotics (Asante & Ntow 2009; Tariq *et al.,* 2007).

2.2.2.1 Overview of Conventional Production in Ghana

The main system of agricultural production in Ghana is traditional, conventional production which relies on the use of chemical fertilisers, pesticides, weedicides and other agrochemicals used in the production of crops. Agrochemicals use remains a common practice and forms an integral part of the main agricultural production system in Ghana. The conventional production system dates back to the colonial era and has been the mainstream agricultural practice in Ghana. The hoe and cutlass are the main farming tools. There is little mechanised farming, but bullock-drawn farming is practised in some places, especially in the Northern part of Ghana.

The conventional production system started on the basis that, out of the total area of 13 628 179 ha suitable for agriculture in Ghana, only 57.58 % of the land is cultivated because the soils are infertile and only productive with proper management and good agricultural practice (SRID, 2011). Soil factors are important in the farmers' decision to grow conventionally. Also, the need to increase food supply has resulted in the use of crop protection chemicals, fertilisers, improved water and soil management as a means to obtain better yields (Carvalho, 2006).

Currently, Ghana does not manufacture chemical fertilisers and all fertilisers used in Ghana are imported (SRID, 2011). The major importers of fertilisers into Ghana are private companies, the Agricultural Development Bank through the Government of Ghana, and some commercial farms. Compound fertilisers are the most-imported fertilisers; these include ammonium sulphate and muriate of potash being major import, with urea, single super phosphate and triple super phosphate being minor imports for the past ten years (FAO, 2005). Compound fertilisers accounted for 48 % of the total amount of fertilisers consumed in Ghana, with nitrogenous fertilisers (urea and ammonium sulphate) accounting for 30 % of the total fertilisers consumed (SRID, 2011).

The government of Ghana supplies subsidised chemical fertilisers to conventional farmers at the start of the growing seasons. Conventional farmers sell their produce to any market that is available to sell at, unlike organic farmers that sell to specific niche markets, both at the domestic and international level. In Ghana, conventional production practices and public health sectors activities remain the major contributors of pollutants into the environment (Fiankor, Donkor, Lowor & Yeboah, 2011). A systematic review of an integrated picture of agrochemicals, especially pesticides, and their exposure to humans, animals, plants, water, soil/sediment and atmosphere in Ghana has revealed that, although the usage of agrochemicals in Ghana has contributed immensely to increased food supply and improvement in public health, it has caused tremendous harm to the environment. Water bodies, fish, vegetables, food, soil and sediment have been found to be pesticide-contaminated in various farming communities (Fiankor *et al.,* 2011). There is considerable evidence that farmers overuse agrochemicals, especially pesticides. Some Ghanaian farmers, field workers and consumers are at higher risk of contracting acute and chronic health effects associated with intensive use of pesticides (Fiankor *et al.*, 2011).

The intensive use of pesticides also leads to unacceptable residue levels in exportable products that constitute a barrier to international trade. Many pressure groups, consumer associations, non-governmental organisations and international bodies are against the presence of these persistent pesticides in the environment. These associations perceive the presence of pesticide residues in the environment and food products as detrimental to human health and water quality (Fiankor, *et al.*, 2011).

There are several production systems that have emerged, over time. The study reviewed literature on conventional, certified and non-certified production systems. The focus of the study is directed towards the adoption of certified organic production and accordingly the next

section presents factors that influence farmers' choice of certified organic production systems from among the other production systems discussed.

2.3 Empirical Literature on Factors Influencing Farmers' Choice of Certified Organic Production among other Production Systems

Factors influencing farmers' choice of production systems have received some attention in recent literature. Factors influencing farmers' choice of production systems have been classified as personal factors, attitudinal and behavioural factors, social factors, physical factors and institutional factors (Caswell, Fuglie, Ingram, Jans, & Kascak, 2001; Kallas, Serra & Gil, 2009; Läpple, 2010).

2.3.1 Personal Factors

The personal characteristics that have been found to influence farmers' choice of certified organic production systems from among other production systems include education, farming experience, household size, off-farm economic activity, farm income and wealth of the farmer.

- **Education**

The educational level of farmers in a country is very important if the country is to domestically produce, adapt, transfer and receive new technologies. Education is found to create a favourable mental attitude for the acceptance of new information-intensive and management-intensive practices (Caswell, *et al.,* 2001). Omani & Chizari (2011) and Radwan, Gil, Diab, Y. & Abo-Nahoul (2011) have argued that education positively influences the adoption of organic farming, as compared with conventional production. The positive influence indicates that the higher the level of education, the more likely a farmer will be to adopt a certified organic production system. However, Hollaway, Shankar & Rahman (2002) have argued that education negatively influences farmers' decisions to adopt certified organic production. The authors claimed that education can encourage new technology adoption by lowering learning costs, or it may discourage adoption since education provides more profitable off-farm employment opportunities. The effect of educational level on the choice of certified organic production system is either positive or negative.

- **Farming Experience**

Farming experience comprises the knowledge and skills of farming practices gained by a farmer, either through his or her practice of farming or through education on farming. Kallas *et*

al. (2009) and Läpple (2010) revealed that farmers' knowledge and skills of farming practices gained by them through their production practices positively influence the choice of a certified organic production system. When treating the pineapple farmers' choice of a production system as a technology adoption decision, it is expected that the more experienced pineapple farmers with a higher level of informal or indigenous farming knowledge would be more willing to choose certified organic production systems, compared with the other production systems. Hattam & Holloway (2005) found that the more a farmer is experienced in farming, the higher the likelihood is of him or her maintaining a conventional production system. The authors argued that certified organic producers are mostly new entrants to farming and are usually highly educated and idealistic. A similar result was found by Ghane Namdar & Chizari (2009) and Razzaghi-Borkhani, Rezvanfar & Shabanali Fami (2010), who ascertained that less experienced farmers are also willing to adopt certified organic farming because less experienced farmers are less risk averse and may adopt organic practices faster. Due to their different views, the direction of the impact of pineapple farmers' experience on the choice of certified organic production system can be positive or negative.

- **Household Size**

Kisaka-Lwayo (2007) and Burton, Rigby & Young (1999) found the household size of farmers to have a positive influence on the adoption of a certified organic production system, compared with a conventional production system. The probability of farmers' adopting certified organic production system increases as household size increases. Organic production is labour intensive and requires technical knowledge which can be obtained from farming experience (Burton *et al*., 1999). Most farming households use their family labour for most farming activities, and as such, a large family size is an indication of availability of labour, more importantly when the household members are part of social networks and associations since the knowledge and skills obtained will be applied on the farm (Staal, Baltenweck, Waithaka, de Wolff & Njoroge, 2002). Larger household sizes are expected to choose a certified organic production system, compared with conventional production systems.

- **Off-Farm Economic Activities**

Beus & Dunlap (1994) and Fairweather (1999) found that if a farmer or a proportion of the farmer's household engage in off-farm activities and rely on off-farm income sources to subsidise farm operations and capital investment, this tends to positively relate to conventional production behaviour. The authors found that farmers who have off-farm employment activity do not adopt certified organic production systems because their off-farm activity did not allow

them to search for organic crops. Off-farm activities will have a negative influence on the choice of a certified organic production system. However, Batz, Peters & Janssen (1999) found that a positive relationship exists between farmers and farmer household members with off-farm activity and the adoption of certified organic production systems. The authors argued that farmer and farmer household's off-farm activities serve as an additional income source that seeks to increase the total income of farmers. The increase in income enables the farmer to have greater access to resources, which the farmer may be able to invest in certified organic production. Due to the different views, the direction of the influence of off-farm economic activity on the choice of certified organic production system is ambiguous, thus, the sign can either be positive or negative.

- **Farm Income**

IFAD (2003) and Soltani, Azadi, Mahmoudi & Witlox (2013) revealed that the level of income from the farm compared with the off-farm activities has a significantly positive influence on farmers' decision to adopt certified organic production, as opposed to conventional production. The authors argued that farmers with higher annual farm incomes have the purchasing power to cover the additional cost associated with certified organic production and this facilitates the adoption of certified organic production. Farm income is mostly affected by the type of labour use on the farm, particularly when a higher proportion of hired labour is used (Soltani *et al*., 2013). Higher farm income is expected to have a positive influence on farmers' choice of certified organic production systems, compared with conventional production systems.

- **Wealth of Farmer**

The number of durable assets owned by a farmer is considered to be his wealth (Kleemann, 2012). Farmers' durable assets owned have been found to significantly influence the choice of a certified organic production system, compared with a conventional production system. Kisaka-Lwayo (2012) and Kleemann (2012) identified wealth of farmer (operationalised as the number of durable goods owned by a farmer) to positively influence farmers' choice of certified organic production, compared with conventional production. The higher the value of assets owned, the higher the likelihood of farmers to choose certified organic production. Kassie, Zikhali, Manjur & Edwards (2009) mentioned that the wealth of farmers affects adoption decisions, since wealthier farmers have greater access to resources and may be able to invest in technologies compared to those with low income. The wealth of the pineapple farmer will have a positive influence on farmers' choice of certified organic production system compared to other production systems.

2.3.2 Attitudinal and Behavioural Factors

Factors related to farmers' attitude and behaviour have been found to influence farmers' choice of a certified organic production system from among other production systems. Among the attitudinal and behavioural factors are the perceived compatibility of the current production system with a certified organic production system, farmers' perception about price premiums, perceived high cost of certification and absence of national regulations, profitability of certified organic production, and farmers' environmental concerns. Other factors found to influence farmers' choice of a certified organic production system include the type of labour use on the farm, contracts with certified organic pineapple exporters or processors, organic extension contacts, training on organic farming, availability of information on certified organic production and marketing, access to credit, access to subsidised chemical inputs, and access to organisational support.

- **Perceived Compatibility of Current Production to Certified Organic Production**

Farmers whose current practices and farm structures are compatible with certified organic production systems will be more likely to adopt certified organic production (Kleemann, 2012). Kleemann (2012) argued that converting to an organic production system would require structural changes on the farm that are different from the current production practices. The changes may require extra cost in implementation, which tends to increase the overall production cost. Economic constraints tends to discourage some pineapple farmers from using more synthetic inputs for production, which makes their production system similar and easy to convert to certified organic production. Therefore, farmers who perceive their current production practices to be compatible with certified organic production are expected to have a higher probability of adopting certified organic production, rather than conventional production systems.

- **Premiums for Organic Product**

According to Fairweather (1999) and Serra, Zilberman & Gil (2008), farmers' perception about price premiums obtained from certified organic products are found to be a powerful instrument for motivating the adoption of certified organic production, especially when the farmer can easily convert to a certified organic system without much structural changes and cost. Niemeyer & Lombard (2003) found that the added financial attractiveness of certified organic production is a factor influencing a farmer's adoption of certified organic production. If the certified organic production is not financially attractive, farmers will not convert, even if their

production system is compatible with certified organic production. Thapa & Rattanasuteerakul (2011) also identified satisfaction with price of certified organic vegetables to positively influence the adoption of certified organic vegetable production. Farmers who agree that certified organic products attract higher price premiums are more likely to adopt certified organic production systems. Farmers who perceive organic price premiums to be high are therefore likely to adopt certified organic production systems.

- **Perceived High Cost of Certification and Absence of National Regulations**

The cost of certification of organic farming has been found to be one of the key factors influencing organic farming adoption (Khaledi, Weseen, Sawyer, Ferguson & Gray, 2010; Sharifi, Sadati, Rostami, Ghobadi, Sadati, Mohamadi & Tolou, 2010; Rezvanfar, Eraktan & Olhan, 2011). In developing countries, certification of farms is one of the challenges for farmers adopting certified organic farming (Bello, 2008). Organic farmers adopt certain farming practices which are inspected annually according to the international rules. Some developing countries do not have national certification bodies that may verify organic products officially and farmers have to use international certification bodies. Some of these organic farmers in developing countries are smallholder farmers who cannot afford certification as an individual since such certification systems are very expensive (Mahdavi-Damghani, 2007; Javanmard & Mahmoudi, 2008; Sharifi *et al*., 2010). Therefore, farmers who have the perception that certification cost is very high and exceeds the perceived organic premiums are expected not to adopt certified organic production and as such, a negative sign is expected.

- **Environmental Concern**

Environmental concern of farmers has been identified to influence farmers' choice of certified organic production systems. Farmers' environmental attitudes have a positive effect on certified organic adoption (Vanslembrouck, van Huylenbroeck & Verbeke, 2002; Burton, Rigby & Young, 2003; Defrancesco Gatto, Runge & Trestini, 2008; Läpple, 2010; Best, 2010). Farmers who express a higher level of environmental concern tend to have a higher probability of adopting certified organic farming, despite the perceived high cost of certification. Best (2010) indicated that there is a direct, as well as an indirect, effect of farmers' environmental concern on the probability of adopting certified organic farming due to the risk that conventional production poses for the environment. The indirect influence is the increasing preference for environmentally friendly consequences and thus, increasing the expected utility of environmentally friendly alternatives. On the other hand, the direct effect occurs when farmers with pronounced pro-environmental attitudes are more likely to act in environmentally

friendly ways, even if expected utility is reduced. Burton *et al*. (1999) added that the probability of adopting certified organic production increases if the farmer is concerned about the environment. Farmers who are concerned about the impact of their production systems on the environment are expected to adopt certified organic production.

- **Type of Labour Use**

The types of labour used have an influence on the choice of certified organic production from among other production systems. Saker *et al*. (2010) revealed that organic farms that have large proportions of family labour are more likely to adopt certified organic production. Feder, Just & Zilberman (1985) explained that organic production requires more manual labourers than conventional farming does. The authors reported that a large number of family members who are able to join on-farm activities enables farmers to adopt labour-intensive technology. Carolyn (1999) identified higher proportions of hired labour used on the farm to negatively influence the choice of a certified organic production system from among other production systems. Carolyn (1999) argued that the higher the numbers of hired labourers are, coupled with longer distance from home to farm, the higher the costs are, since farmers pay for the transportation for the hired labourers. The higher the dependence on hired labour is, the lower the likelihood of the farmer adopting a certified organic production system will be. Family labour is expected to have a positive influence on the choice of certified organic production systems.

- **Contract with Certified Organic Pineapple Exporters or Processors**

Farmers who have a written contract with certified organic pineapple exporters or buying agents tend to choose organic production systems, since contract farming provides the farmer with an assured organic market and specific standards to use in production (Radwan *et al.*, 2011). However, not all the farmers have contracts with produce buyers. Farmers who have contracts are more likely to adopt certified organic production systems to meet the requirements of export buying companies or local processing companies, based on their specifications. Extension agents often work as coordinators between farmers and exporters, as well as buying agents. Also, some companies and exporters provide organic inputs to contract farmers, which enable them to produce organically and enable them to meet the standards required. Having a contract with an exporter or processor is expected to have a positive influence on the choice of either non-certified or certified organic production systems, compared with conventional production systems.

- **Organic Extension Contact**

Understanding the impact of extension agencies on the choice of a certified organic production system is particularly important, given the weakening status of extension delivery. Saker *et al.* (2010) examined the impact of extension services and the types of extension services as a factor influencing Bangladesh farmers' decisions to adopt certified organic production. The results revealed that farmers' access to either public or NGO extension services has a significantly positive influence on the adoption of certified organic production systems. Farmers who have frequent contact with extension agents, who have adequate information, knowledge and experience on certified organic production and marketing systems, tend to have a higher probability of choosing either a non-certified or a certified organic production system, compared with a conventional production system (Kaufmann, Stagl & Franks 2009). Frequent contact with an experienced extension officer (advisors or extension agents that have knowledge on organic production) is expected to have a positive influence on farmers' choice of certified organic production systems.

- **Training on Organic Farming**

Training of farmers on agricultural production is a means of improving farmers' informal education, management ability and skills. Training of farmers contributes to farming experience, especially when the training focuses on the production practices related to the farmers' production system. According to Saha, Love & Schwart (1994) and Lindner (1987), training on production systems improves the farmers' abilities to acquire accurate information, evaluate new production processes, use new agricultural practices and understand the benefits of adopting appropriate production practices. Farmers' decisions to adopt certified organic production constitute one of the results of their knowledge and ability to use organic practices and meet stringent certification requirements (Naik, Srivastava, Godara & Yadav, 2009). Thapa & Rattanasuteerakul (2011) identified farmers' attendance at training courses on certified organic production practices to positively influence adoption of certified organic production, compared with conventional, in Thailand. As the amount of training a farmer receives on certified organic production system increases, the higher is the likelihood of the farmer choosing certified organic production practices, compared with other production practices. This is because training programmes might assist farmers to acquire adequate information and higher levels of knowledge on technical, marketing and financial issues related to certified organic production. Training will have a positive effect on pineapple farmers' choice of certified organic production systems, compared with other production systems.

- **Availability of Information on Certified Organic Production and Marketing**

The availability and source of information on certified organic production and marketing are very important in determining farmers' adoption decisions. Lack of access to market information is another cause of the higher levels of transaction costs which affect farmers' participation in organic niche markets (Jordaan, 2012). Parra López & Calatrava (2005) revealed that the availability of information on organic production practices, markets and prices of organic products influence farmers' choices of certified organic production systems. Kallas, Serra & Gil (2010) confirmed that the presence of a local authority serving as a source of information tends to increase the chances of farmers' converting to certified organic production. The presence of a certified organic information source is expected to increase the chances of farmers adopting certified organic production systems. The availability of information sources on certified organic production tends to have a positive effect on the farmers' choice of certified organic production systems.

- **Access to Credit**

Kallas *et al*. (2009) have argued that difficulties in obtaining loans are directly related to certified organic production adoption. Lack of access to credit will have a positive influence on farmers' choice of a certified organic production system. The reason is that lack of access to credit in a form of inputs or cash may constrain farmers from purchasing synthetic inputs for conventional production, which tends to compel the farmer to choose organic production which requires less input. Farmers who have contracts with certified organic exporters and companies sometimes receive credit in a form of input or cash to support their production. The total input costs account for a higher proportion of cost of production which has resulted in small-scale farmers adopting low-input production, such as non-certified and certified organic production. The authors also revealed that conventional production involves high capital investment, and as a result, the lack of access to loans is more likely to reduce the probability of farmers adopting conventional production systems. Lack of access to credit is expected to have a positive influence on farmers' choice of certified organic production.

- **Access to Subsidised Chemical Inputs**

Constance & Choi (2010) and Ghorbani, Liaghati & Nemati (2011) found that the agricultural policies in most developing countries do assist the organic sector. The supply of subsidised inputs, such as chemical fertilisers and some agrochemicals, to farmers favours conventional production systems. The supply of subsidised agrochemicals to farmers by the Ministry of Food and Agriculture is expected to have a negative influence on farmers' decisions to adopt

certified organic production systems because the inputs supplied are mainly for conventional production systems, and once farmers receive the inputs they may be forced to adopt conventional farming, ceteris paribus. Thapa & Rattanasuteerakul (2011) have also argued that farmers could sell the subsidised inputs received and use the money received to purchase organic inputs, and hence the higher the number of subsidised inputs obtained, the higher are the chances of the farmer choosing certified organic production.

- **Access to Organisational Support**

The knowledge-intensive nature and requirements of certified organic production systems render support services from governmental organisations and NGOs an important factor in small-scale farmers' adoption of certified organic production systems. Ghorbani *et al*. (2011) and Constance & Choi (2010) identified the absence of support from governmental organisations as being a barrier to the adoption of certified organic production, thus revealing that inadequate infrastructural support for certified organic production would influence adoption. Governmental organisations, NGOs and private companies provide several support services to small-scale farmers, which serve as an incentive for adopting certified organic production systems. The support services include the provision of organic farm inputs (for example, organic fertilisers and improved varieties), capacity building on diverse aspects of organic production, market-oriented information, advisory services, and supporting payment of group certification (Mahboubi & Keshnizi, 2010; Kleemann, 2012; Adebiyi, 2014). The more the support services a farmer receives, the more likely a farmer is to adopt certified organic production. Farmer's access to support services from governmental organisations or NGOs is expected to positively influence the choice of certified organic production system.

2.3.3 Social Factors

Social factors are related to the social environment within which the farmers operate. Social factors comprise informal constraints, such as customs, traditions, and societal norms, that have influence on farmers' behaviour. A social factor found to influence farmers' choice of certified organic production from among other production systems is the level of social capital of farmers.

- **Social Capital**

Social capital is defined as features of social organisation (for example trust, norms, volunteerism, reciprocity, networks, association, traditions and beliefs) that can improve

societal efficiency by facilitating coordinated action (Putnam, 1993, as cited by Jordaan, 2012). Social capital features, such as networks and associations, are linked to training of individual.

Most farmer-based associations and networks offer training to farmers. Social capital is acknowledged as being an important factor behind sustainable livelihood and economic development, because trust, volunteerism and network facilitate cooperation among farmers (Pretty & Ward, 2001; Milagrosa 2007b). Social capital also facilitates participation and effectiveness in collective action initiatives, such as exchange of information, mutual help and access to credit, which will influence individual farmer's decisions (Grischow, 2008). The exchange of information will decrease the occurrence of information asymmetry and reduce the transaction costs among farmers, and between farmers and traders, and so liberates resources.

Various aspects of social capital have been found to influence farmers' choices of certified organic production systems from among other production systems. Läpple (2010) identified farmers' relationship with other organic farmers to positively influence the adoption of certified organic production. This confirms findings of Kaufmann *et al.* (2009) and De Cock (2005) who asserted that the social environment (consisting of farmers, commercial agents, finance company, partner, family, consumers, etc.) is an important aspect in farmers' decision-making, particularly in regard to seeking information about production systems. Thapa & Rattanasuteerakul (2011) also identified motivational and capacity building among individual farmers to have a positive and significant influence on the choice of certified organic production. The repeated interaction among farmers increases trust levels. Farmer's membership of cooperatives, rural unions and farmers' associations have been found to positively influence the choice of certified organic production (Burton *et al*., 1999; Hattam & Holloway, 2005). High levels of farmers' participation in civic organisations will result in high levels of association among farmers, which will encourage their collective behaviour and improve the effectiveness of collective actions (Milagrosa, 2007b). Farmer-based organisations endeavour to generate information and establish contacts that allow contracting, production and marketing planning, communication, and monitoring, in order to keep organic production costs at low levels. Training, support services, certification and marketing of organic products in developing countries, including Ghana, are normally collective initiatives. This implies that farmers with higher levels of social capital are expected to more frequently attend these collective sessions, relate better to other farmers, and trust other farmers in the network to perform the duties that are expected of them. Social capital is expected to positively influence the choice of certified organic production systems.

2.3.4 Physical Factors

Physical factors have been found to influence farmers' choices of certified organic production from among other production systems. The farm characteristics identified in literature to influence farmers' choices of certified organic production systems include farm size, certified organic market availability, and access to and distance from farm to market.

- **Farm Size**

The impact of farm size on farmers' choices of production systems is one of the key issues in most developing countries because the average size of farm holding has been declining over the years (Kisaka-Lwayo, 2007). The size of farmland available to a farmer influences the choice of production system suitable for farming. Farm size has been found to have a negative influence on farmers' decisions to adopt certified organic production in a number of empirical studies (Fertô & Forgács, 2002; Kallas *et al*., 2009; Läpple, 2010; Radwan *et al*., 2011). The emphasis on farm size was attributable to the fact that organic farms are more work-intensive than conventional farms are. The larger the farm size, the more difficult it is for the farmer to manage, and as such this increases the likelihood of the farmer choosing conventional production practices. Smaller farms appear to have greater propensity for adopting certified organic production (Feder *et al*., 1985). Large farm size is expected to have a negative influence on farmers' choices of certified organic production systems, compared with conventional production systems.

- **Access and Availability of Certified Organic Market**

According to Greene, Dimitri, Lin, McBride, Oberholtzer & Smith (2009); Constance and Choi (2010); and Soltani *et al.* (2013), the basic underlying factor that influences a farmer to adopt certified organic production is the availability and access to certified organic markets. The market demand and growth in demand for certified organic products are very influential in farmers' choices of certified organic production systems and on how much acreage to cultivate. Burton *et al.* (1999) found that the probability of adopting certified organic production increases if the farmer has access to the available market. Various organisations along the organic pineapple value chain assist farmers in selling their products by linking them to the available marketing channels, as well as providing information on market prices. The growth in demand for certified organic products might make the organic market attractive and trigger the entry of large-, medium- and small-size farmers, as well as inducing organic farmers to produce more certified organic products, ceteris paribus. Access to available certified organic

market is expected to have a positive influence on farmers' choices of certified organic production systems.

- **Distance from Organic Farm to Organic Market**

The location of a farm, according to Rigby & Young (2000), impacts on a farmer's decision-making with regard to the adoption of a certified organic production system. There is a negative relationship between the distance from the farmlands to the available organic market and farmers' decisions to adopt certified organic production. The authors argued that the longer the distance is from the farm or farming lands to the certified organic market, the higher are the transaction costs and the higher the chances are that farmers will choose to grow conventionally and sell their produce at the nearby market. Increased transaction costs will also affect farmers' participation in organic niche markets (Staal *et al.,* 1997; Holloway *et al.,* 2000; Khaledi *et al.,* 2010). The longer the distance is to the certified organic market, the lower the chances will be of farmers' choice of certified organic production systems, compared with conventional production systems (Padel, 2001). The distance to certified organic market has a negative influence on the choice of a certified organic production system, compared with a conventional production system.

2.3.5 Institutional Factors

Factors relating to the institutional environment have been found to influence farmers' choices of certified organic production systems. Institutional factors comprise formal rules and informal constraints and they serve as incentive structures. A major institutional factor found to influence farmers' choices of certified organic production is the form of land tenure and security existing in the farming community.

- **Land tenure and security**

Land tenure is defined as the system of rules, rights, institutions and processes, under which land is held, managed, used and transacted (Cotula, 2006). Harrison (1990) demonstrated that farmers' rights to natural resources can be important in determining whether they take a short- or long-term perspective in managing resources. The ownership of farmlands by the farmer tends to affect the farmer's choice of production systems. The various types of land tenure systems have been identified to influence the adoption of certified organic production, either positively or negatively. Fertô & Forgács (2002) and Kallas *et al.* (2009) identified rented farmland and family land to have a negative influence on the adoption of certified organic

production. The authors revealed that if the larger part of the farm land is rented or family owned, landlords in Hungary and Catalonia in Spain do not allow farmers to produce organically. The objections from landlords may also have a negative influence on the adoption of certified organic production. Farmers who produce on their own land are likely to adopt certified organic production, since such farmers can make long-term investments. Farmers who farm on rented or family land are less likely to adopt certified organic production and this is expected to have a negative influence on farmers' choices of certified organic production systems.

Several factors of the social, physical and institutional environment influence the adoption of certified organic pineapple production systems, from among other production systems. However, knowing the factors alone is not enough. The methods employed in identifying these factors are very important. Hence, the next section presents the methods used in estimating the factors influencing farmers' choices of production systems in literature.

2.4 Methods of Estimating Factors Influencing Farmers' Choice of Production System

Estimating factors that influence farmers' choices of production systems has received some attention in recent literature. According to Kisaka-Lwayo (2012), the analytical methods that have been employed to analyse the adoption of certified organic production systems from among other production systems under static and dynamic process can be categorised into two; namely non-parametric approaches and parametric or econometric approaches. The non-parametric approaches are approaches that do not estimate parameters, whereas the parametric approaches make use of estimation procedures, such as ordinary least squares and maximum likelihood estimation techniques, to estimate parameters.

2.4.1 Non-Parametric Approach

The non-parametric approaches that have been used in analysing factors influencing farmer's choice of certified organic production system are ethnographic decision tree modelling (Fairweather 1999; Darnhofer, Schneeberger & Freyer 2005), descriptive statistics (Cranfield *et al.,* 2010; Duram, 1999) and qualitative narrative (Duram, 1999; Brock, 2010). The decision tree model was used by Fairweather (1999) and Darnhofer *et al.* (2005) to assess farmers' decisions between organic and conventional production in Austria and New Zealand, respectively. According to Darnhofer *et al.* (2005), the decision-tree permits the identification

of decision criteria and examines the decision-making processes of farmers in choosing their farming method. Cranfield *et al.* (2010) and Duram (1999) used descriptive statistics, such as percentage, mean and principal component analyses, to examine the factors influencing the adoption of certified organic agriculture. For the purpose of this study, non-parametric approaches (both qualitative description and quantitative descriptive statistics, such as means, frequency and percentages) were used to describe an integrated value chain (VC) and new institutional economics (NIE)–structure-conduct-performance (SCP), VC-NIE-SCP framework. The integrated VC-NIE-SCP framework enables a comprehensive analysis and understanding of factors influencing farmers' behaviour.

2.4.2 Parametric or Econometric Approaches

The most widely used econometric approaches for analysing the factors that influence farmers' choices of organic production systems include probit, logit and Tobit models, multinomial logit model, linear discriminant function, and duration analysis (Jansen, 1992; Lohr & Park, 2002; Gardebroek & Jongeneel, 2004; Isgin, Bilgic, Forster & Batte, 2008; Kallas *et al.,* 2009; Radwan *et al.,* 2011).

The probit model is widely used in analysing factors influencing farmers' decisions to adopt certified organic production (Albisu & Laajimi, 1998; Lohr & Salomonsson, 2000; Gardebroek, 2002; Hattam & Holloway, 2004; Hattam & Holloway, 2005; Isin, Cukur & Armagan 2007). The probit model was used by these authors since they measured the adoption choice as binary and assumed that the error term is normally distributed. Various authors have added an intrinsic order to the probit model and used the ordered probit model in estimating factors influencing farmers' choices of production systems, particularly when there are more than two alternatives for the farmers to choose from (Calatrava & González, 2008; De Cock, 2005; Genius, Christos, & Tzouvelekas, 2006; Kisaka-Lwayo, 2012).

The logit model has been used by a number of authors in analysing factors influencing farmers' decisions to choose certified organic production. Among the authors are D'Souza, Cyphers & Phipps (1993), Anderson, Jolly & Green (2005), Fertô & Forgács (2002), Parra López & Calatrava Requena (2005), Rigby & Young (2000), Saker *et al*. (2010), Thapa & Rattanasuteerakul (2011) and Torres, Marshall & Alexander (2013). The logit model was used by these authors since they measured their dependent variables as binary and assumed that the error term is logistically distributed across all the sampled respondents. Khaledi *et al.* (2010) used the Tobit model to analyse factors influencing partial and complete adoption of organic farming practices in Saskatchewan: the Tobit model, according to the authors, was

used due to the inclusion of both the conventional and certified organic farmers, and as such, some of the observations were censored. Thus, Tobit model is used when the dependent variable is measured as a continuous variable and that has zero observations.

Duration analytical techniques have been used by Kallas *et al.* (2009), Läpple (2010), Pietola & Oude Lansink (2001) and Radwan *et al.* (2011) in analysing the adoption of certified organic farming. Duration analysis is an analytical technique that allows for the controlling of both the occurrence of an event (i.e. whether a farm adopts the organic agriculture or not) and the timing of the event (that is, when the adoption takes place). Duration analysis techniques are appropriate to account for right censoring and easily handle time-varying covariates. The duration analysis also allows for overcoming the limitation arising from considering farm characteristics previous to the sample period, or at the time of starting, as the unique determinant of farm survival over time (Radwan *et al.,* 2011). Discriminant analysis was used to identify the characteristics that distinguish between fully-certified organic, partially-certified organic and non-organic farmers in KwaZulu-Natal by Kisaka-Lwayo (2007).

The multinomial logit model is also widely used in determining factors influencing farmers' choice of production systems. The multinomial logit is used when the dependent variable is not binary but contains more than two alternatives production systems (Burton *et al*., 1999; Anderson *et al.,* 2005; Läpple & Van Rensburg, 2011). The authors argued that the dependent variables used in the multinomial estimations are more than two and had no ordering which will require ordered probit model. This means that the multinomial logit model is appropriate when the dependent variable has more than two alternatives with no intrinsic order.

Non-parametric and Parametric approaches have been identified as analytical methods that have been employed to analyse the adoption of certified organic production systems. Each of the identified approaches has their strength and weakness; however, the focus of the study has necessitated the use of both analytical approaches to obtain a comprehensive understanding of the factors within the social, physical and institutional environment that influence the choice of pineapple production systems. Given the fact that the aim of the study is to determine the social, physical and institutional factors influencing the choice of a certified organic production system, the next section will focus on the literature on the VC-NIE-SCP framework. The VC-NIE-SCP framework will enable the researcher to analyse the social, physical and institutional environment within which farmers produce and market pineapples.

2.4.3 The Integrated Value Chain and New Institutional Economics (Nie) – Structure-Conduct-Performance (SCP) Framework

The integrated VC-NIE-SCP framework was developed by Jordaan, Grové & Backeberg (2014) as a conceptual framework that can be used to analyse the agri-food chains within which small-scale farmers operate, with the aim of improving the financial performance of the farmers, and hence the level of success with which they operate in their value chains. The framework was first used by Jordaan (2012) to characterise Eksteenskuil farmers' raisin production and marketing in South Africa. The framework was developed by integrating the integrated New Institutional Economics (NIE) and Structure-Conduct-Performance (SCP) framework developed by Milagrosa (2007a) into the value chain framework of Roduner (2007). The resulting new framework (VC-NIE-SCP framework) examines the three levels of agri-food value chains suggested by Roduner (2007) in four interrelated levels of a sector (social embeddedness level, institutional environment and structure level, governance structures and conduct level, and resource allocation and performance level). Figure 2.2 below shows the four levels of analysing the three levels of agri-food chain depicted by Jordaan *et al.* (2014), with each level addressing specific issue in the value chain. The framework shows that the social embeddedness and the institutional environment and structure levels constitute the value chain influencers of the agri-food chain. The governance structure and conduct level, and the resource allocation and performance level, are used to analyse the value chain players and supporters of the agri-food chain.

From the framework, Jordaan *et al.* (2014) theorised a relationship between the components of the VC-NIE-SCP framework. The relationship between the components (levels) of the VC-NIE-SCP framework, as suggested by Jordaan *et al.* (2014), is that the social environment (social embeddedness level) imposes constraints on the institutional and physical environments (institutional environment and structure level) within which the various value chain players and supporters operate. The institutional and physical environments in turn impose constraint on the behaviour (governance structures and conduct level) of value chain players and supporters, which in turn determines the performance and the way value chain players and supporters allocate their resources (resource allocation and performance level).

From the framework, this relationship is bi-directional in the form of reverse causation because of the dynamic nature of the integrated VC-NIE-SCP framework (Milagrosa, 2007a; Jordaan *et al*., 2014). That is, in the long run, feedback from the performance of the value chain players and supporters will have an influence on the behaviour (conduct and governance structures), and indirectly on the physical, institutional and social environment, within which they operate.

Next, the respective components of the integrated VC-NIE-SCP framework are discussed in more detail, with special emphasis on the features of each component that was considered in characterising the various pineapple production systems.

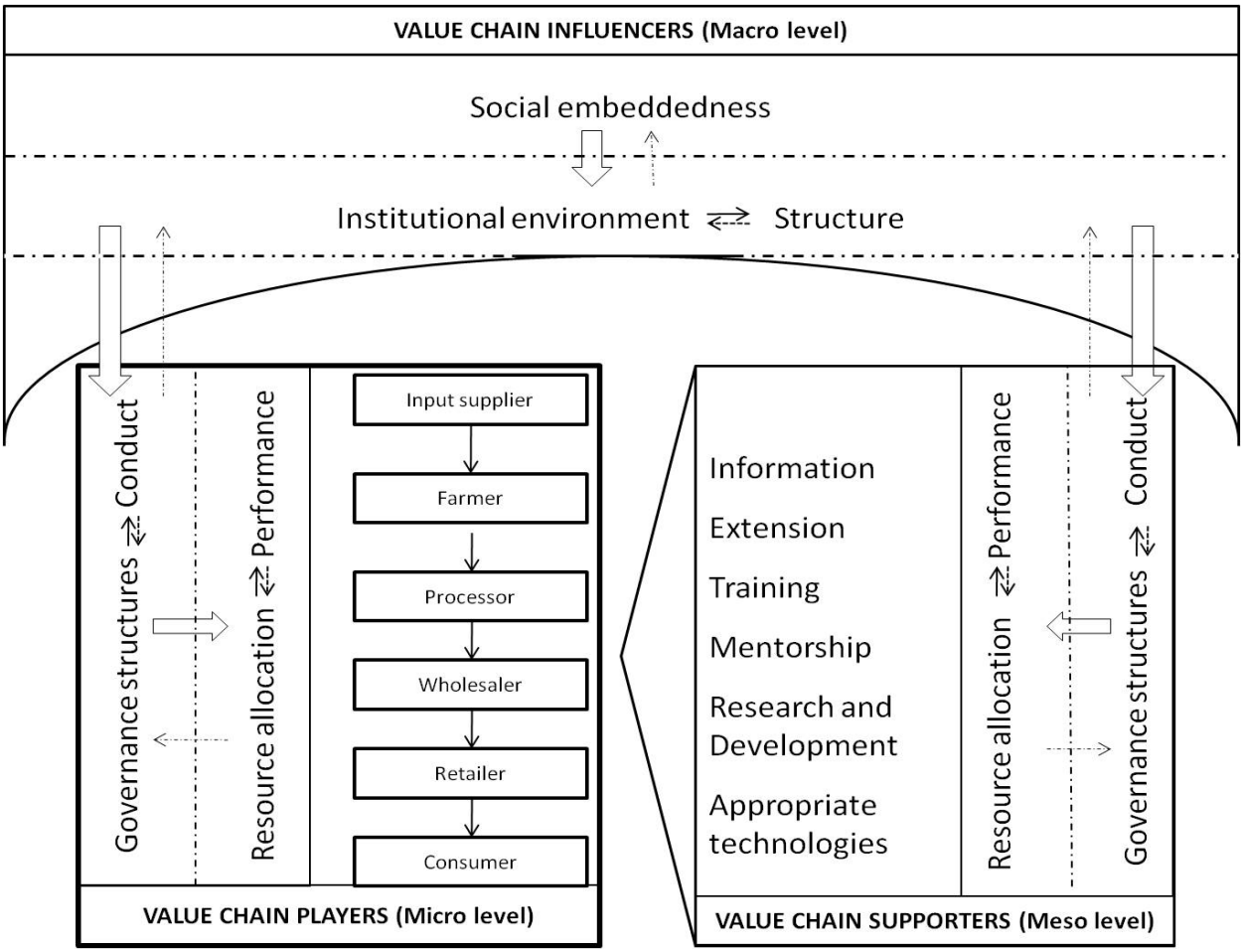

Figure 2.2: Integrated VC-NIE-SCP framework for agri-food value chain analysis for poverty alleviation

Source: Jordaan *et al.* (2014)

- **Social Embeddedness (Level 1 of VC-NIE-SCP)**

Social embeddedness refers to customs, traditions and societal norms that affect the behaviour of the economic agents under consideration (Williamson, 2000). The level of social embeddedness is often taken as given by economists since changes in social embeddedness occur at rates of centuries to millennia (Williamson, 1998, as cited by Jordaan *et al.,* 2014). The concept of social embeddedness allows researchers to explain the influence of informal constraints on institutional and physical environment and the behaviour of value chain players. The level of social embeddedness of farming communities and farmers has been analysed using social capital theory (Milagrosa & Slangen, 2005; Milagrosa, 2007a; Jordaan, 2012).

Social capital is defined as “features of social organisation (for example trust, norms volunteerism, reciprocity, networks, traditions and beliefs) that can improve societal efficiency by facilitating coordinated action” (Putnam, 1993, as cited by Jordaan, 2012). The social embeddedness level will be analysed using social capital levels of the pineapple farmers.

- **Institutional Environment and Structure (Level 2 of VC-NIE-SCP)**

The second level of the VC-NIE-SCP framework comprises combining the institutional environment (Level 2 of NIE) with structure (Level 1 of SCP). From the framework, there is a bi-directional relationship between institutional environment (Level 2 of NIE) and structure (Level 1 of SCP). The institutional environment influences the farm and market structure and similarly farm and market structure is also influenced by rules and regulations that are included in the institutional environment. According to Milagrosa (2007), the institutional environment and structure effectively constrain production and feasibility of economic activities in an intangible (formal rules and informal constraints) and tangible (physical limitations) sense.

Institutional environment (Level 2 of NIE): Institutional environment refers to all of the formal rules and informal constraints that regulate the way transactions are carried out (Williamson, 2000). The formal rules include, among others, constitutions, laws, and other rules put in place by government to protect actors involved in the production and marketing of agricultural products against opportunistic behaviour (North, 1994, as cited by Jordaan, 2012; Jordaan *et al.,* 2014). The informal constraints of the institutional environment include norms of behaviour, self-imposed codes of conduct, and non-political, non-economic and unwritten conventions such as taboos and traditions (Milagrosa, 2007a; Jordaan *et al.,* 2014). Changes of formal rules and informal constraints with the institutional environment occur at the slow rate of 10 years to a century (Jordaan, 2012).

The importance of the institutional environment revolves around the fact that institutions form the incentive structure of the various production systems and therefore plays a significant role in shaping events at the downstream levels of governance and resource allocation (Jordaan *et al*., 2014). The institutions available to farmers using a particular production system are the main factors that will influence economic performance and consequently the livelihood of poor farmers. The production and marketing of pineapple using the different production system will require small-scale farmers to meet strict rules and regulations.

Structure (Level 1 of SCP): Structure refers to the characteristics of the market or industry that have a strategic influence on the nature of competition and pricing behaviour within the

market (Allen, Reeves & Mumma, 1999). According to Milagrosa (2007a) and Jordaan (2012), the structure component of the SCP can be separated into farm structure and market structure. The farm and market structure describes the physical environment within which the pineapple farmers operate. The farm structure refers to the physical features of the region and distribution of land, as well as land ownership and tenure (Milagrosa, 2007a). The characteristics of the region that are of importance include the specific location, its topography, the size of the population in the region, the proportion of the population involved in agriculture, the main crops produced in the region, and the total land area in the region. Also, characteristics of farm structure include the average size of farms, the distribution of farm sizes, the different systems of land ownership and tenure, the number of farms related to the respective tenure systems and the distribution of land under the respective tenure systems.

The market structure refers to the features of the organisation of the market. The features of market structure include different types of markets that are available, location of input and output markets, market infrastructure, degree of market concentration, different marketing channels, actors who are involved in moving the physical product from the farm to the final consumer, and the degree of product differentiation (Amare, 2010; Louw, Geyser, Troskie, van der Merwe, Scheltema, & Nicholson, 2010).

- **Governance Structures and Conduct (Level 3 of VC-NIE-SCP)**

The third level of the VC-NIE-SCP framework is concerned with the incorporation of governance structures (Level 3 of NIE) with conduct (Level 2 of SCP). This level of the VC-NIE-SCP framework assess the governance structures that are used to enforce the rules and regulations for the value chain players and supporters, as well as the behaviour (conduct) of value chain players and supporters within the farm and market structure.

Governance structures (Level 3 of NIE): Governance structures refer to the way in which a transaction (production and marketing activities) is organised within the rules and regulations as defined by the institutional environment (Milagrosa, 2007a; Jordaan *et al.,* 2014). According to Williamson (1985), three types of governance structures are generally distinguished in agri-food chains. At one end of the spectrum lies a purely anonymous spot market (the market price provides incentives for the exploitation of profit opportunities) while the other end of the spectrum consists of hierarchy or vertical integration (parties are under unified ownership or control). Between those two modes of governance lies a variety of hybrid modes, such as contracts and partial ownership. The availability of different governance structures means there will be different governance structures that have been identified as being efficient by

farmers using different production systems. For the purpose of the study, the focus of attention is the governance structures associated with the transaction between the pineapple producers and traders in Ghana, thus excluding that of the value chain supporters.

Conduct (Level 2 of SCP): Conduct refers to the patterns of behaviour that firms follow in adopting or adjusting to the markets or industry in which they produce, sell or buy (Amare, 2010). The conduct component of the SCP framework can be divided into production and marketing conduct (Milagrosa, 2007a; Jordaan, 2012). Production conduct is concerned with the production practices used by pineapple farmers under the various production systems and the sources and availability of credit to those farmers to fund production activities (Milagrosa, 2007a). Market conduct, on the other hand is concerned with the behaviour of the farmers or competitive strategies used by farmers to market their pineapples (Hai, 2003). The features for assessing the marketing conduct of each production system include the sources and availability of market information, the method of price formation, investment in technical training and services, the behaviour of the traders in the market, the level of competition in the market, the types of contracts that are employed, and the marketing strategies that are followed by the farmers. For the purpose of this study, the behaviour of the supporters is limited to the extent of their behaviour in supporting pineapple farmers in the production systems under consideration.

- **Resource Allocation and Performance (Level 4 of VC-NIE-SCP)**

The fourth and final level of the VC-NIE-SCP framework is concerned with the merging of resource allocation (Level 4 of NIE) and performance (Level 3 of SCP). The framework captures the bi-directional relationship between the resource allocation and performance. The degree of efficiency with which production inputs are used has a direct influence on the performance of the farmers under consideration, and vice versa.

Resource allocation (Level 4 of NIE): Resource allocation refers to quantities, prices, margins, costs and shares. The main concern of resource allocation is with marginal analysis to analyse productive and allocative efficiency (Milagrosa, 2007a). At the level of resource allocation, production and market performance is evaluated with special reference to the quantities produced and marketed, production and marketing costs, and price analysis in the form of farmer's and traders' share of total market sales (Milagrosa, 2007a). Resource allocation is analysed with neoclassical economic theory in the form of marginal analysis, where the firm, again, is described as a production function (Williamson, 2000). Neoclassical economics is thus concerned with the allocation of resources in an optimal manner, which is

the level where profit and/or utility are maximised. Optimal allocation of resources implies that the resources are allocated efficiently (Jordaan, 2012).

Performance (Level 3 of SCP): Performance refers to economic outcome resulting from the impact of industry or market structure and conduct on prices, costs and volume of output (Pomeroy & Trinidad, 1995; Hai, 2003). The performance component of the SCP analysis is concerned with the actual volumes and quality of the respective crops that were produced, the income, costs, profit levels, an analysis of the marketing margins and production and marketing efficiency (Milagrosa, 2007a). The variable mostly used to measure performance is the price-cost margin of the farmers (Tiku, Olukosi, Omolehin & Oniah, 2012). The performance component of SCP framework is linked to efficient structure hypothesis, which proposes that the performance of the firm is positively related to its efficiency.

2.5 Conclusion

The overview of the pineapple sector in Ghana revealed that pineapple is one of the important crops with significant contribution to the economy of Ghana. The contribution of the sector to the livelihood of smallholder farmers in the pineapple producing regions of Ghana justifies the promotion of certified organic pineapple as a strategic crop for rural development.

The review of production systems indicated that there are three production systems available for farmers to choose from. The identified production systems include conventional production systems and organic production systems. The organic production system is comprised of certified and non-certified production systems. The review indicated that the attention of stakeholders is directed towards certified pineapple production due to its benefits. The choice of a particular production system is influenced by several factors, as the review of empirical literature indicates.

The review of literature on factors influencing farmers' choices of certified organic production systems revealed that personal factors, such as education, farming experience, household size, off-farm economic activity, farm income and wealth of the farmer, influence the farmers' choices of certified organic production systems.

Factors that are related to farmers' attitude and farming behaviour have been found in the review of literature to influence farmers' choices of certified organic production systems from among other production systems. Among the attitudinal and behavioural factors are farmers' perception about price premiums, perceived profitability of certified organic production,

perceived compatibility of current production system to certified organic production system, farmers' perception about the absence of national organic regulation and certification cost, and farmers' environmental attitude. Other factors, such as the type of labour use on the farm, contracts with certified organic pineapple exporters or processors, organic extension contacts, training on organic farming, availability of information on certified organic production and marketing, access to credit, access to subsidised chemical inputs, and access to organisational support also influence farmers' choices of certified organic production systems. Hence, these factors were hypothesised to influence Ghanaian pineapple farmers' choices of certified organic production systems.

Factors related to the social environment, such as social capital level of the farmers, were found in the literature review to influence farmers' choices of certified organic production from among other production systems. Social capital is a feature of social organisation (for example trust, norms, volunteerism, reciprocity, networks, association, traditions and beliefs) that can improve societal efficiency by facilitating coordinated action.

Physical factors, such as farm size, certified organic market availability, and access and distance from farm to market, were found in the literature review to influence farmers' choice of certified organic production from among other production systems. Therefore, farm size, certified organic market availability, and access and distance from farm to market were included in the hypothesised model to influence Ghanaian pineapple farmers' choice of a certified organic pineapple production system.

Factors that are related to the institutional environment within which the farmers in the communities operate were found in the review of literature to influence farmers' choice of a certified organic production system. The institutional factor found to influence farmers' choice of certified organic production is the form of land tenure and security existing in the farming community. Land tenure and security is also included in the hypothesised model to influence Ghanaian pineapple farmers' choice of certified organic production system.

Following next is a review of methodologies for analysing factors influencing the adoption of certified organic production system from among other production systems. The multinomial logit model is appropriate and as such is selected for analysing the factors that influence farmers' choice of pineapple production systems in Ghana. This is because the farmers or respondents have three production systems to choose from, and these production systems are not arranged in any order, nor does it have any intrinsic order. However, before analysing the influence of factors using the multinomial logit, an integrated VC-NIE-SCP framework was

deemed appropriate to be used to analyse the social, physical and institutional environment, as well as the way farmers behave in arriving at important factors.

The integrated VC-NIE-SCP framework allows for a comprehensive analysis of the value chain under consideration. The framework analyses the social embeddedness level that contributes to a better understanding of the levels of trust in the community as part of the social capital analysis, the institutional environment and structure which consist of formal rules and informal constraints, the behaviour (conduct and governance structures) of value chain players and supporters, and the resource allocation and performance which concerns the degree of efficiency with which resources are used.

CHAPTER 3

DATA AND METHODOLOGY

The purpose of Chapter 3 is to describe the data and the procedures employed in the study. The first section involves the description of the data, which includes a description of the study area, how the questionnaire was developed, and the sampling approach used in the study. Also included in the data section is the survey and the characteristics of the respondents considered in the study. The second section describes the procedures employed in analysing the specific objectives of the study and the conclusions.

3.1 Study Area

3.1.1 The Central Region of Ghana

The Central Region is located in the southern part of Ghana and is one of ten administrative regions. Figure 3.1 below sets out a map of Ghana to indicate the physical location of Central Region. It is bordered by the Ashanti and Eastern regions to the north, the Western Region to the west, the Greater Accra Region to the east, and to the south by the Gulf of Guinea. The region has a coastline of 150 km, and is the longest coastline in Ghana. It is the smallest region after the Upper East and Greater Accra Regions of Ghana. The Central Region is divided into two zones: the coast and the hinterland, and falls within the dry equatorial and moist semi-equatorial zones. As a result, the region experiences a bi-modal rainfall pattern and therefore has both major and minor growing seasons. The wettest months are May–June and September–October, while the drier periods occur in December–February and a brief period in August. The annual rainfall experienced in the region ranges from 1 000 mm along the coast to about 2000 mm in the interior. There are variations in temperature experienced in the region. The coolest month (August) has mean monthly temperature of about 24^0C, whereas in the hottest months (March–April) the mean monthly temperature is about 30^0C. The long coastline in the region gives the region a humid climate. The relative humidity in the region is between 50 to 85 %. The Region is one of the major pineapple production areas in Ghana. Figure 3.1 below shows the location of central region in Ghana and the pineapple production areas in Ghana. The major pineapple producing areas are Greater Accra and Central Regions,

indicated by the strip lines, and the minor producing areas are the Ashanti, Eastern and Volta Regions of Ghana, indicated by the dark shaded areas as shown in Figure 3.1 below.

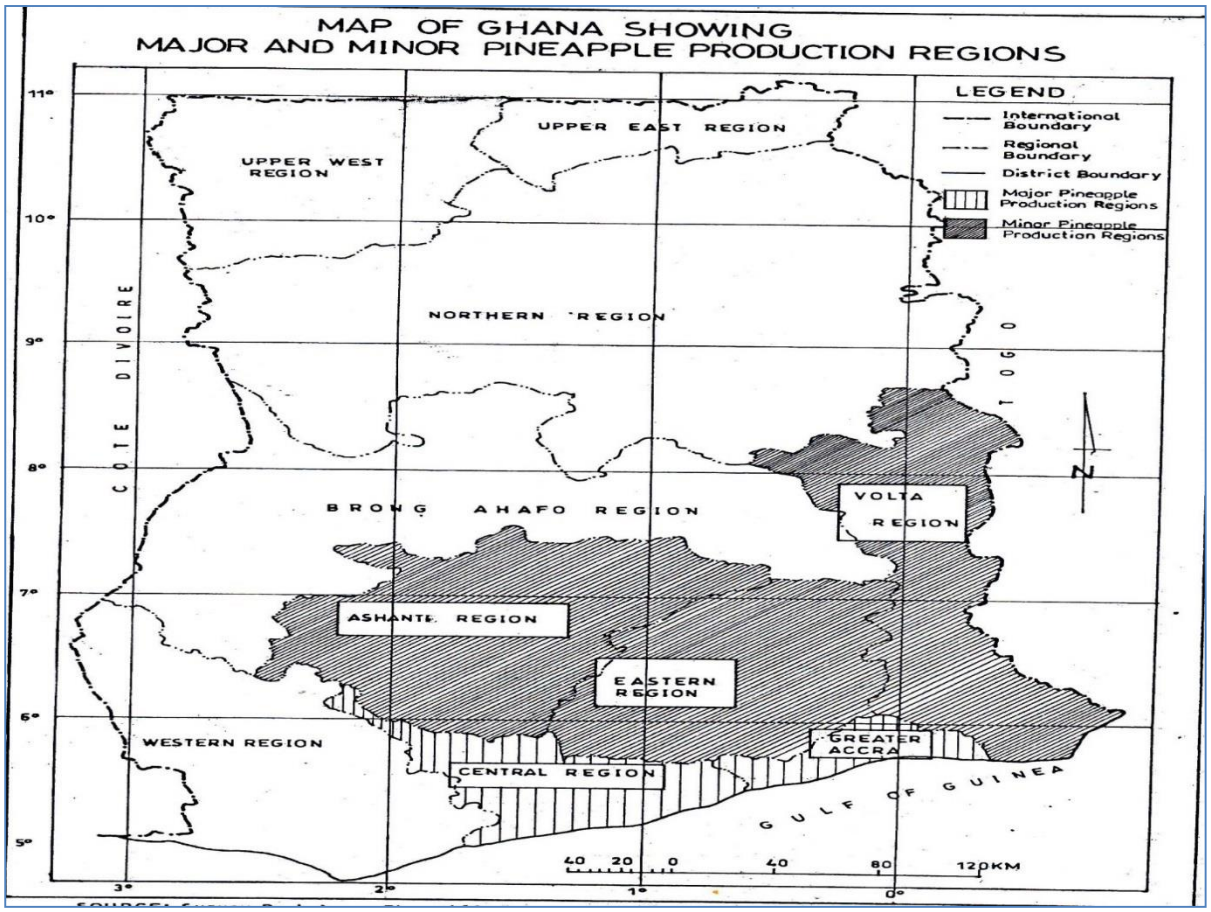

Figure 3.1: Map of Ghana showing the physical location of Central region and pineapple production areas

Source: Accra Survey Department, Ghana (2014)

The coastal areas in the region are characterised by undulating plains with isolated hills and occasional cliffs, sandy beaches and marshy areas. The hinterland area in the region has lands rising between 250 metres and 300 metres above sea level. In terms of vegetation, coastal savannah with grassland and few trees exist along the coast, while semi-deciduous forest pre-dominates the inland areas. Much of the original dense forest vegetation has been cleared for the cultivation of cocoa and oil palm.

The population and housing census (PHC) of 2010 reported a population of 2 201 863 for the Central Region and this accounts for about 8.9 % of the country's population (GSS, 2008; 2012). Some 85.7 % (1 886 997) of the population are in the labour force, with about 62.5 % engaged in agriculture and its related activities (SRID, 2011). This indicates that agriculture

provides employment and livelihood opportunities for more than half of the population in the region.

The total land area of Central Region is about 9 830 km^2 (983 000 ha). About 7 864 km^2 (786 400 ha) is classified as agricultural land. Out of the total agricultural land, 393 200 ha are under cultivation. The average farm size is 0.5 hectares (1.235 acres). The small farm holdings might be attributed to the high growth rate of the population in the region. Nonetheless, there are a few large farm holdings in the region, thus showing the existence of a dual farm structure in the region. A dual farm structure indicates the existence of small farms owned by a large number of farmers, alongside big farms owned by a few farmers in the region (Milagrosa, 2007a).

Land ownership and tenure are important aspects of the farming structure in the region. Generally, the indigenous people in the region own the land through family or kingship ties, where distribution and use of the land is in the hands of family heads. The cultivation of these lands by non-indigenous people, and other indigenous people without access to family lands, is done through other forms of tenure arrangement, such as leasehold or rented, outright purchase, inheritance of family land, and “abunu” and “abusu” (sharecropping) systems of acquisition.

Input supply stores are located in most districts, as well as in farming villages in the region. Few farmers need to travel outside farming communities in order to purchase farm inputs. There are several open-air markets and farmers markets in each district for trading of farm produce. All the input suppliers are privately owned companies and hence are responsible for the infrastructure themselves. The general feeling among pineapple farmers in the Central Region is that the infrastructure at the input suppliers and market is averagely good in quality.

Good farm-to-market roads are necessary for transporting farm produce. The road network in the region ranges from asphalted main roads to unpaved village-level roads. The roads from the farms to the villages are mostly unpaved, whereas the roads from the villages to the markets are mostly asphalted roads. The conditions of the roads in the Central Region are averagely good. The general feeling among pineapple farmers in the central region is that the road network linking their farm to market is fairly good in quality. However, some farm-to-village roads are inaccessible during the raining seasons.

3.1.2 Cropping Structure and Farming Techniques

The main crops that are currently produced in the region are maize, rice, cassava, yam, cocoyam, vegetables and fruit crops, such as citrus, pineapple; mango, banana, and water melon. Pineapple is the main NTAEs produced in the region and its production is done on a commercial basis (Kleemann, 2011). Figure 3.2 below sets out a map of the Central Region, showing the pineapple producing districts in the region. Eight districts supply produce for domestic and export markets. The varieties of pineapple that are cultivated in the district are sugarloaf, smooth cayenne and MD2, with sugarloaf being the dominant variety. Pineapple farmers, like most other crop farmers in the districts, practise traditional farming techniques, such as using hoe and cutlass, with little- or un-mechanised agriculture. In terms of water use for pineapple farming activities, the vast majority of farmers use water from rivers and streams close to farms during the wet season, and pipe-borne water during the dry season, as most districts in the region have no formal irrigation schemes.

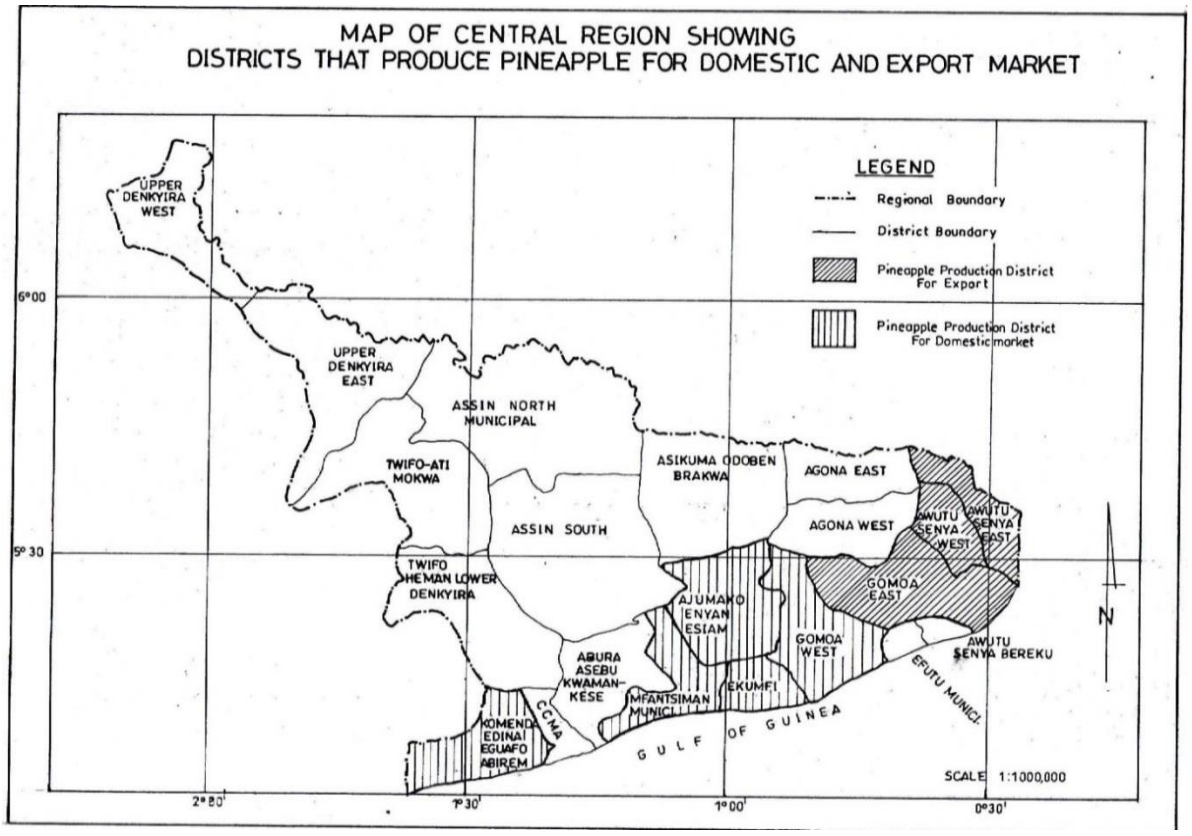

Figure 3.2: Map of Central Region to show the study area and pineapple production districts in the study area

Source: Accra Survey Department, Ghana (2014)

3.2 Data Collection

3.2.1 Development of Questionnaire

A questionnaire (see Appendix A) was developed to obtain the relevant information on the farmers' personal characteristics, attitudinal and behavioural factors, social factors, physical factors and institutional factors that are hypothesised to influence farmers' choices of a particular pineapple production system in Ghana. The questionnaire also includes questions that pertain to the structure, conduct and the institutional environment within which the farmers operate. First, a questionnaire/checklist was designed for the focus group discussion with the selected farmers extension agents, and key informant interviews with agricultural directors and heads of various institutions. The questionnaire for the focus group discussion involved questions on key policy variables, particularly on the structure and institutional environment within which the farmers operate. The governance structures and conduct of actors along the pineapple value chain which influence farmers' choices of certified pineapple production systems was also included. The information used to frame the questions on the institutional factors was obtained from the focus group discussion and key informants, as well as from participatory rural appraisal (PRA) with a few farmers, and extension agents and agricultural directors at their residences and offices.

The personal characteristics in the questionnaire include farmers' age, education, farming experience, household size, off-farm economic activity, farm income, and wealth of the farmer. The wealth of the farmer was measured by the value of the number of physical assets of farmer households. The attitudinal and behavioural factors considered in the questionnaire include the perceived compatibility of current production system with certified an organic production system, farmer's perception about certified organic price premiums, perception about cost of certification and absence of national regulations, the perceived profitability of certified organic production, and environmental attitude. Also included under attitudinal and behavioural factors are the type of labour use on the farm, training on organic farming, contracts with export and processing companies, availability of information on certified organic production system, extension contacts, access to credit, sources of credit, amount of credit received, sources of marketing and production information, access to subsidised chemical inputs, and organisational support.

The social factor included is the social capital index of farmers. The physical factors consist of farm size, availability and access to certified organic markets and distance from farm to market. The institutional factors in the questionnaire consist of land tenure and security system

in the pineapple farming community and knowledge of various institutions in the pineapple sector. In addition, information on the number of farms related to the respective tenure, and the distribution of land under the respective tenure system, was included.

Other factors included in the questionnaire are marketing channels, inputs used and cost, and volume of output and sales of pineapple. The questionnaire was designed to comprise a combination of open-ended and closed-ended questions, Likert-type scales and options where the farmers rate their choices in level of importance of the identified institutional variables which were obtained from the farmers and extension agents through the focus group discussions and key informant interviews with agricultural directors and heads of various institutions. Pre-testing of the questionnaire was done with 10 farmers to test the adequacy and the precision of the questionnaire in answering the research questions.

3.2.2 Sampling Procedure and Conduct

The primary data was collected using focus group discussions, key informant interviews and the structured questionnaire. The multistage sampling approach was employed. The first stage involves the purposive selection of the Central Region of Ghana, based on two reasons. Firstly, the region is one of the major pineapple production areas in Ghana, with farmers producing for both the domestic and international markets. Secondly, organic pineapple production is being promoted in the region to sustain livelihoods of small-scale rural poor farmers. Secondly, stratified random sampling was employed in stratifying the eight pineapple producing districts in the region.

The pineapple producing districts in the region were stratified into two, based on target markets sorted into export and domestic markets. Two districts were randomly sampled from each stratum. Awutu-Senya West and Gomoa East Districts were randomly selected from the districts producing for domestic markets, whereas Komenda Edina Eguafo Abirem (KEEA) and Gomoa West Districts were randomly selected from the districts producing for exports markets. From each of the selected districts, 50 farmers were selected from a list of pineapple farmers from the districts' agricultural offices and farmer-based organisations. Additionally, Ekumfi District was purposively sampled because the preliminary study revealed that the district has a large number of small-scale organic farmers. From the Ekumfi District, 100 farmers were selected using simple random sampling. It must be emphasised that the difference in the number of farmers from the districts is based on proportion sampling (Kothari, 2004). In all, a total of 5 districts and 300 farmers were sampled for the study. The sample was comprised of both certified and non-certified organic farmers, as well as conventional

farmers. The population of farmers in all the districts is not known, and as such, a sample of 300 farmers was sufficient to provide the robustness and the representation required for the study.

Five agricultural directors and five extension officers responsible for pineapple production in the sampled districts were selected for key informant interviews. Thirty experienced farmers, 10 under each production system, were purposively selected for the focus group discussions on the production systems. Three focus group discussions were conducted for the study. Face-to-face interviews were conducted with the directors and departmental heads of the following institutions: GEPA, in charge of pineapple exports; Certification bodies; the GSB; and the horticultural and Plant Protection and Regulatory Services Departments (PPRSD) of MoFA. These interviews were carried out to obtain detailed information and documents on the characteristics and requirements that the farmers need in order to produce and market under each of the production systems.

Introductory letters were sent to the directors, extension officers and the selected farmers to seek permission, and arrange a date, for the interviews and discussion. All the respondents partook in the interview at their own free will and at times of their convenience. The data was collected from 16 February to 22 April, 2015, for the production period of January 2012 to December 2014. A total of five enumerators, together with the author, conducted the face-to-face interview with the farmers. The enumerators were trained before the data collection took place.

3.3 Characteristics of Respondents

This section presents a discussion of the surveyed farmers' types of production systems, personal characteristics, attitudinal and behavioural characteristics, social capital, physical factors, and institutional factors. A total of 300 questionnaires were administered during the survey. Certain questionnaires were left incomplete, resulting in 295 questionnaires which were valid and used in this study.

3.3.1 Types of Production Systems Used for Pineapple Production

The study identified three different production systems adopted by pineapple farmers in the Central Region of Ghana. The three main systems for producing and marketing pineapples were the certified organic, non-certified organic and conventional production systems. Figure 3.3 below shows the number of respondents using the various pineapple production systems.

The survey data shows that among the 295 farmers interviewed, the majority (140) were practising conventional pineapple production, while 79 were certified organic producers, with the least in number being non-certified organic farmers.

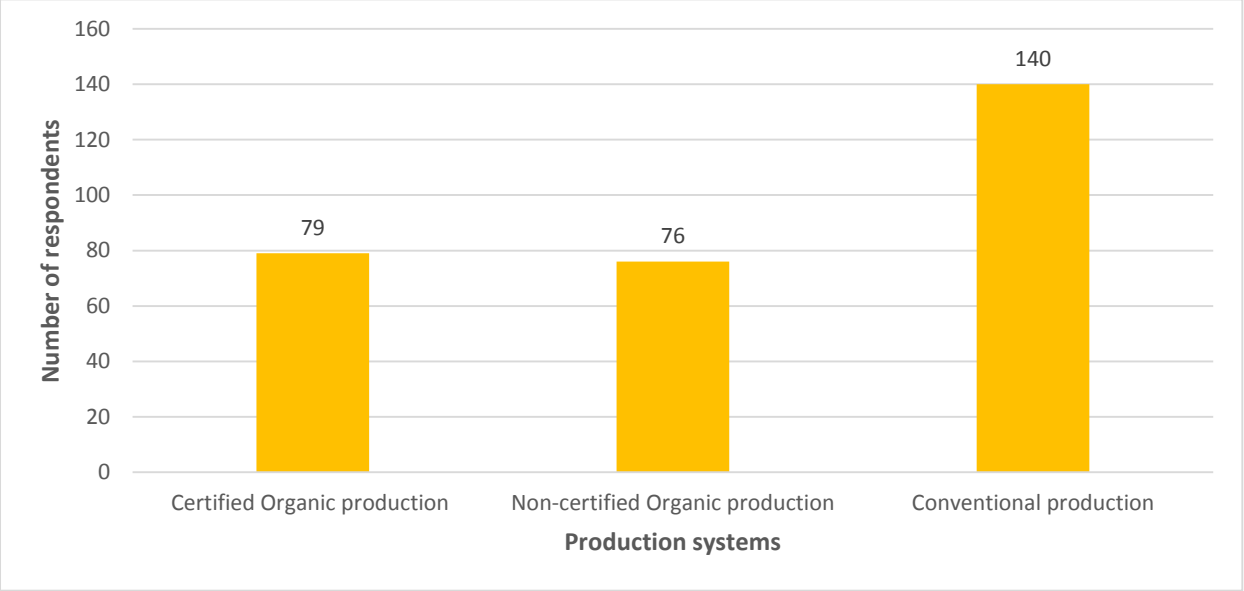

Figure 3.3: Distribution of production systems types used by farmers in the Central Region

3.3.2 Personal Characteristics

The questionnaire captured the personal characteristics of the farmers, which include gender, marital status, educational level, off-farm activity, age, pineapple farming experience, household size, household annual, and farm income and wealth. The personal characteristics are grouped according to the production systems. The distributions of gender and marital status of the pineapple farmers are presented in Table 3.1 below.

Table 3.1: Gender and marital status distributions of pineapple farmers

Variable	Certified organic		Non-certified organic		Conventional	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Gender						
Female	7	8.9	13	17.1	7	5
Male	72	91.1	63	82.9	133	95
Marital Status						
Single	6	7.6	9	11.8	12	8.6
Married	73	92.4	67	88.2	128	91.4

Under certified organic pineapple production, males are found to be in the majority (91.1 %), while the remaining 8.9 % were females. Similarly, 82.9 % of the non-certified organic

producers were males, while 17.1 % were females. Ninety-five per cent (95 %) of the conventional farmers were males, while 5 % were females. The survey data indicate that, generally, females' participation in pineapple production is low. However, a relatively high percentage of females is associated with non-certified pineapple production. The results indicate that 92.4 % of the certified organic farmers were married, 88.2 % of the non-certified farmers were married, while 91.4 % of the conventional farmers were married.

The educational level of a farmer has an influence on the farmer's choice of production system, and accordingly educational level was analysed according to production system. The distributions of the educational levels are presented in Figure 3.4 below. The results show that the lowest level of education was no formal education, and the highest level of education was undergraduate university education. For no formal education, there were 8 certified organic farmers, 10 non-certified organic farmers, and 31 conventional farmers who had no formal education. In terms of basic school education, there were 60 certified organic, 63 non-certified organic, and 85 conventional farmers.

There were 5 certified, 3 non-certified and 17 conventional farmers who had attained senior secondary school education. As to the total number of farmers who had attained tertiary education (training college and undergraduate university education), Figure 3.4 shows that conventional farmers had the highest (7), followed by certified organic farmers (6), with non-certified organic farmers having none who had attain tertiary education level.

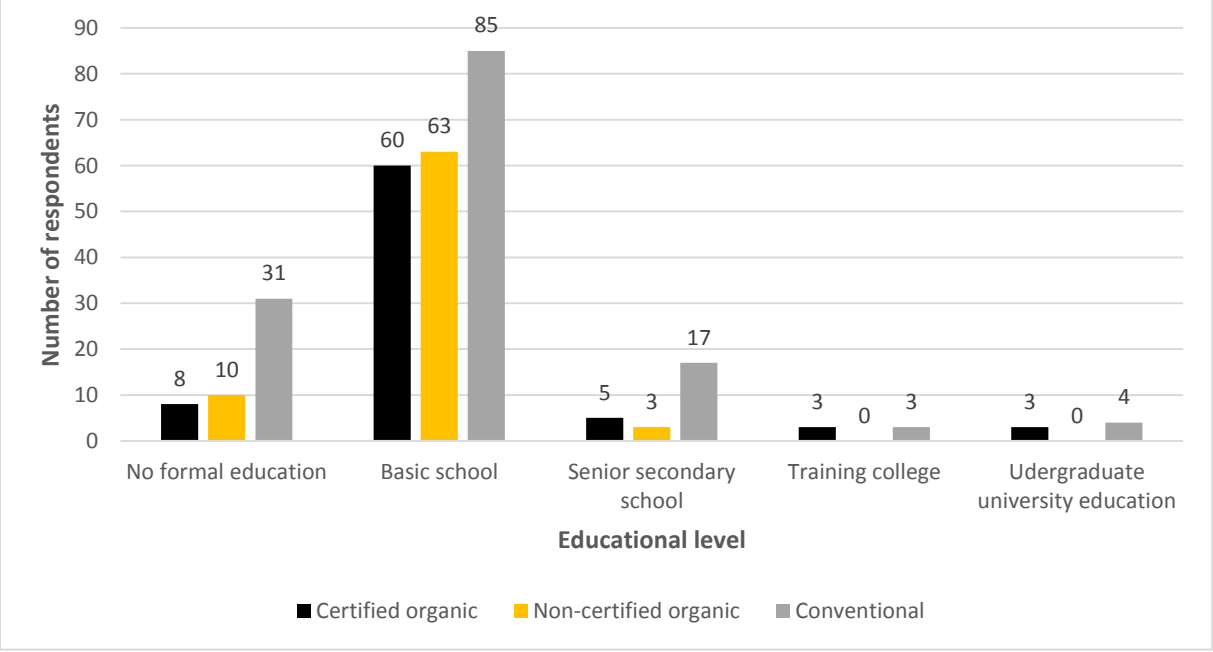

Figure 3.4: Distribution of educational levels of pineapple farmers

Pineapple farmers' engagement in off-farm economic activity has been identified in literature to influence farming activities. Figure 3.5 below illustrates the distribution of pineapple farmers engaged in off-farm activities. Figure 3.5 shows that more than half of the farmers under each pineapple production system are engaged in an off-farm activity. However, a high proportion of conventional farmers (61.4 %) are engaged in off-farm activity, followed by non-certified organic farmers (60.5 %), with certified organic farmers having the lowest number of farmers (54.4 %) engaged in off-farm activity.

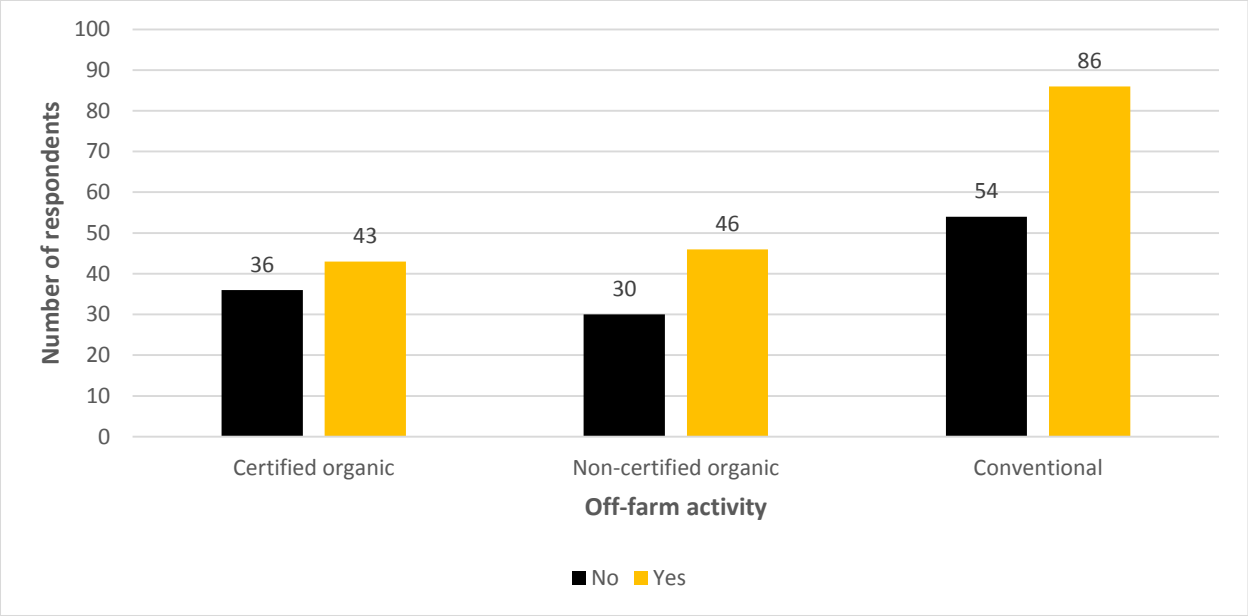

Figure 3.5: Distribution of farmers' engagement in off-farm activity

The descriptive statistics of the socio-economic characteristics of the pineapple farmers for the three production systems are presented in Table 3.2 below. The average age for certified farmers was about 47 years, which is higher than both non-certified and conventional farmers, with average ages of about 43 and 41 years, respectively. On average, certified organic farmers had been producing pineapple for about 14 years, while non-certified had been cultivating pineapple for over 10 years. For conventional farmers, they had been producing pineapple for over 7 years. Certified organic farmers had relatively larger average households of 8 people, with 3 people who are able to work on the farm. Conventional farmers had an average of 7 people in the household, out of which 3 are able to help with the farming activities, while non-certified organic farmers had the smallest household size of 6 people, with 3 persons who can assist them on the farm. Furthermore, conventional farmers had an average annual household income of GH¢ 8 101.93, which is higher than that of non-certified and certified organic farmers, with average annual household incomes of GH¢ 7 151.32 and GH¢ 3 865.76, respectively. However, non-certified organic producers obtained a higher average

income of GH¢ 80.91, followed by certified organic producers with average income of GH¢ 78.30.

Table 3.2: Descriptive statistics of socio-economic characteristics of the pineapple farmers

Variable	Certified organic		Non-certified organic		Conventional	
	Mean	S D	Mean	S D	Mean	S D
Age	47.04	13.09	43.26	11.32	41.07	9.03
Pineapple farming experience (Fexp)	14.45	9.21	10.37	8.07	7.57	6.84
Household size	8.00	4.00	6.00	3.00	7.00	3.00
Household size that can work on farm	3.00	2.00	3.00	2.00	3.00	2.00
Household Annual Income (GH¢)	3865.76	3644.61	7151.32	11513.86	8101.93	14103.54
Farm income (GH¢)	78.30	20.20	80.91	22.43	74.85	24.55
Livestock wealth (GH¢)	1120.23	1571.70	1221.11	1729.85	3191.46	11826.14
Physical assets wealth (GH¢)	21646.66	68446.41	13875.71	21511.95	18142.02	25415.43
Total Wealth (GH¢)	22766.89	68466.35	15096.82	22133.45	21333.48	28909.49

Lower farm income is associated with conventional pineapple production. Livestock wealth was captured in the questionnaire in terms of the value of the livestock owned by the farmers as at December 2014. The survey data presented in Table 3.2 above shows that conventional producers had an average livestock wealth of GH¢ 3 191.46, while non-certified farmers had livestock valued at GH¢ 1 571.70. Certified organic producers owned livestock valued at GH¢ 1 120.23. In terms of physical assets wealth, certified organic producers had the higher average value of GH¢ 21 646.66, while conventional and non-certified organic producers had average physical assets valued at GH¢ 18 142.02 and GH¢ 13 875.71, respectively. Physical and livestock wealth were summed to get the total wealth of the pineapple farmers. Generally, certified organic producers had the higher average total wealth of GH¢ 22766.89, followed by conventional farmers (GH¢ 21 333.48), while the lowest total wealth is associated with non-certified organic producers (GH¢ 15 096.82).

3.3.3 Attitudinal and Behavioural Factors

This section seeks to provide a brief discussion of farmers' attitude and behaviour in their pineapple production. Farmers' adoption of production systems is influenced largely by their attitudes, and as such, it is important in their choices for decision-making. The attitudinal and behavioural factors include level of concern for the environment, perception of organic production systems, training attended, access to organic information, access to credit, access

to subsidised inputs, and access to organisational support. Also included in the section are having a contract with an organic company, any organic extension contact received, and the types of labour used by farmers on the pineapple farms.

The level of farmers' concerns for the environment varies from one farmer to another. Hence, the level of concern for the environment was measured on a 4-Likert scale. The distribution of the farmers' levels of concern for the environment is presented in Figure 3.6 below. About 24.3 % of the conventional farmers are concerned with situations in their environment, while 21.5 % and 21.1 % of the certified and non-certified organic farmers, respectively, are concerned with the environment. The majority of the non-certified (53.9 %) and certified (51.9 %) organic farmers are moderately concerned with the environment, while 40.7 % of the conventional farmers are moderately concerned with the environment.

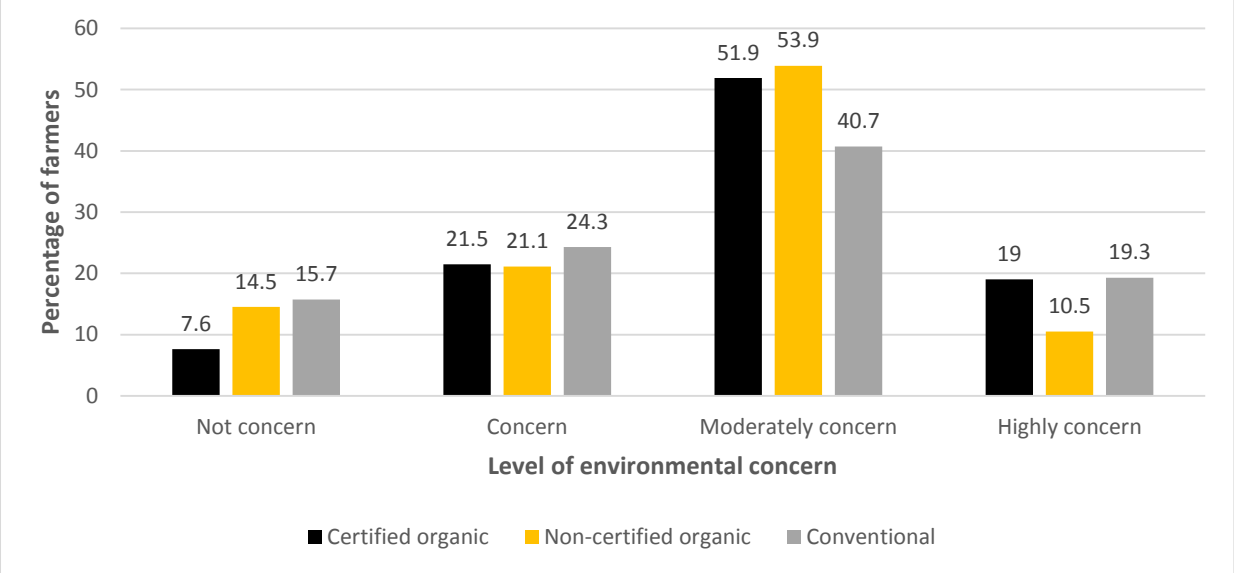

Figure 3.6: Distribution of farmers' level of concern for the environment

About 19 % of the certified farmers are highly concerned with the environment and 19.3 % of conventional farmers are highly concerned with the environment, but only 10.5 % of the non-certified organic farmers are highly concerned with the environment. The general impression is that most of the farmers, particularly the certified and non-certified organic farmers, are more concerned with the environment.

Farmers' perceptions on the financial and institutional aspects of organic production system were investigated and the results are presented in Tables 3.3 and 3.4 below. Each perception

response was measured on a five point Likert scale (with scores from -1 for “strongly disagree” to +1 for “strongly agreed”).

Concerning farmers’ perceptions on the financial aspect of organic production, about 40.5 % of the certified organic farmers strongly agreed, and 43.0 % agreed that organic pineapples attract higher price premium. Some 39.5 % and 44.7 % of the non-certified farmers strongly agreed and agreed, respectively, that organic pineapples attract a higher price premium, whereas 20.7 % of the conventional farmers strongly agreed, and 32.1 % agreed, with the point that organic pineapple attracts a higher price premium. The average scores for perceived higher price of organic pineapple were 0.56, 0.60 and 0.12 for certified organic, non-certified organic, and conventional farmers, respectively. The mean scores indicate that all the categories of farmers have positive perceptions on the premiums. Also, 39.2 % and 31.7 % of certified organic farmers, 27.6 % and 30.3 % of non-certified organic, and 18.6 % and 21.43 % of conventional farmers strongly agreed and agreed, respectively, that the cost of certification for organic pineapple farms is high. The average certification cost perceptions were 0.51, 0.40 and 0.23 for certified, non-certified and conventional farmers, respectively. The mean scores reveal that farmers have positive perceptions on high certification costs and they agree that the certification cost is high, on average. About 45.6 % of the certified organic farmers strongly agreed, and 41.8 % agreed, that certified organic pineapple production is more profitable than conventional pineapple production, while 30.3 % of the non-certified organic farmers strongly agreed, and 40.8 % agreed, that certified organic pineapple production is more profitable than conventional pineapple production. About 17.1 % of the conventional farmers strongly agreed, and 28.6 % agreed, that certified organic pineapple production is more profitable than conventional pineapple production. The average scores for perceived profitability of organic production were 0.62, 0.46 and 0.04 for certified organic, non-certified organic and conventional farmers, respectively. Averaging the three scores on financial aspects for each of the categories of pineapple farmers gave a Finance perception index (FPI) of 0.56 for certified organic farmers, 0.49 for non-certified organic farmers, and 0.13 for conventional farmers. The FPI for the categories of pineapple farmers was positive, although conventional farmers had an extremely low FPI.

Table 3.3: Farmers' perception on financial aspects of organic production system

Perception Statement	Number of respondent					Mean score
	Strongly disagree (-1)	Disagree (-0.5)	Neutral (0)	Agree (0.5)	Strongly agree(1)	
Certified organic farmers perception						
Organic pineapple products attracts higher price premium	0	8	5	34	32	0.56
Cost of certification for organic pineapple farmers is high	1	3	19	25	31	0.51
Certified organic pineapple production is more profitable than conventional pineapple production	2	3	5	33	36	0.62
Finance perception index (FPI)						0.56
Non-certified organic farmers perception						
Organic pineapple products attracts higher price premium	0	3	9	34	30	0.60
Cost of certification for organic pineapple farmers is high	0	4	28	23	21	0.40
Certified organic pineapple production is more profitable than conventional pineapple production	1	6	15	31	23	0.46
Finance perception index (FPI)						0.49
Conventional farmers perception						
Organic pineapple products attracts higher price premium	20	29	17	45	29	0.12
Cost of certification for organic pineapple farmers is high	4	11	69	30	26	0.23
Certified organic pineapple production is more profitable than conventional pineapple production	22	33	21	40	24	0.04
Finance perception index (FPI)						0.13
Overall financial perception index (OFPI)						0.39

Farmers' perceptions on institutional aspects of organic pineapple production were also positive. About 24.1 % of the certified organic farmers, 13.2 % of the non-certified organic farmers, and 9.3 % of the conventional farmers strongly agreed that the absence of local organic regulations and certification bodies in Ghana prevents farmers from adopting certified organic pineapple production systems. On the other hand, about 39.2 % of the certified organic farmers, 48.7 % of the non-certified organic farmers, and 37.9 % of the conventional farmers agreed that the absence of local organic regulations and certification bodies in Ghana prevents farmers from adopting certified organic pineapple production systems. The average scores for perception on the absence of local organic regulations and certification bodies were 0.37, 0.33 and 0.12 for certified organic, non-certified organic, and conventional farmers, respectively. This indicates that farmers are positive and believe that the absence of local organic regulations and certification bodies in Ghana prevents farmers from adopting certified organic pineapple production. The results further revealed that 30.4 % and 43.0 % of the certified organic farmers strongly agreed and agreed, respectively, while 18.4 % and 44.7 % of the non-certified organic farmers strongly agreed and agreed, respectively, that land rights and policy in the Central Region of Ghana favours organic pineapple production, whereas 12.1 % of the conventional farmers strongly agreed and 25.7 % agreed with the point that land rights and policy favours organic pineapple production. These gave mean scores of 0.44 for certified organic, 0.34 for non-certified organic, and 0.05 for conventional farmers.

The other indicators of intuitional perceptions of farmers investigated were perceptions on the smallness of organic market, strictness of organic standards and requirements, and the negative influence of favourable conventional policies. The average scores for perceived smallness of organic market were 0.35, 0.23 and 0.09 for certified organic, non-certified organic, and conventional farmers, respectively. The mean scores for farmers who perceived strictness of organic standards and requirements were 0.42 for certified organic farmers, 0.39 for non-certified organic farmers, and 0.21 for conventional farmers. Also, the perception of farmers of favourable conventional policy gave mean scores of 0.41, 0.23 and 0.16 for the respective pineapple farmers' categories. Conventional farmers had a lower institutional perception index of (0.13) than non-certified and certified organic farmers, with indices of 0.30 and 0.40, respectively.

The study found the overall institutional perception index to be 0.28. This implies that all the categories of farmers have positive perceptions on the institutional factors and this suggests that institutional factors are perceived to influence farmers' choices of certified organic production.

Table 3.4: Farmers' perception on institutional aspects of organic production systems

Perception Statement	Number of respondent					Mean score
	Strongly disagree(-1)	Disagree (-0.5)	Neutral (0)	Agree (0.5)	Strongly agree(1)	
Certified organic farmers perception						
Absence of local organic regulations and certification bodies prevents farmers from adopting certified organic pineapple production system	2	7	20	31	19	0.37
The land rights and policy favours organic pineapple production	4	5	12	34	24	0.44
The small organic market favour organic pineapple production	3	12	14	26	24	0.35
Standards and requirements for producing certified organic pineapples are strict and difficult to meet	1	7	10	37	24	0.42
Favourable conventional production policies does not favour certified organic pineapple production	2	9	15	29	24	0.41
Institution perception index (IPI)						0.40
Non-certified organic farmers perception						
Absence of local organic regulations and certification bodies prevents farmers from adopting certified organic pineapple production system	1	5	23	37	10	0.33
The land rights and policy favours organic pineapple production	0	10	18	34	14	0.34
The small organic market favour organic pineapple production	1	11	29	23	12	0.23
Standards and requirements for producing certified organic pineapples are strict and difficult to meet	1	4	25	28	18	0.39
Favourable conventional production policies does not favour certified organic pineapple production	0	15	18	34	9	0.23
Institution perception index (IPI)						0.30
Conventional farmers perception						
Absence of local organic regulations and certification bodies prevents farmers from adopting certified organic pineapple production system	9	26	39	53	13	0.12
The land rights and policy favours organic pineapple production	9	39	39	36	17	0.05
The small organic market favour organic pineapple production	11	27	45	40	17	0.09
Standards and requirements for producing certified organic pineapples are strict and difficult to meet	8	18	42	51	21	0.21
Favourable conventional production policies does not favour certified organic pineapple production	15	15	43	44	23	0.16
Institution perception index (IPI)						0.13
Overall institutional perception index (OIPI)						0.28

The training that a farmer receives has an influence on the choice of a pineapple production system. Likewise, access to information plays a significant role in farmers' decisions on production systems. Therefore, access to training and market information was estimated and the results are presented in Table 3.5 below.

Table 3.5: Pineapple farmers' attendance of training and access to organic information

Variable	Certified organic		Non-certified organic		Conventional	
	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Training						
No	0	0	10	13.2	46	32.9
Yes	79	100	66	86.8	94	67.1
Type of training						
Organic	77	97.5	46	69.7	3	3.2
Conventional	0	0	12	18.2	80	85.1
Both	2	2.5	8	12.1	11	11.70
Access to organic information (Infoav)						
No	2	2.5	9	11.8	76	54.3
Yes	77	97.5	67	88.2	64	45.7

From Table 3.5 above, it can be seen that all the certified organic farmers (100 %) sampled had received training. The majority of the non-certified organic farmers (86.8 %) had received training and a substantial number (67.1 %) of conventional farmers had also received training. The impression received is that the majority of pineapple farmers have attended pineapple production training. With respect to the specific type of training attended, 97.5 % of certified organic farmers had attended training on only organic production system, while 2.5 % had attended both organic and conventional training, but none had attended only conventional production training. The majority (69.7 %) of the non-certified organic farmers sampled had attended only organic training, 18.2 % had attended only conventional training, and 12.1 % had attended both. With the conventional farmers, 85.1 % had attended only conventional training, 11.7 % had attended both organic and conventional training. Only 3.2 % of the conventional farmers sampled had attended organic training.

In terms of access to organic information, apart from information provided during organic training sections, 97.5 % of the certified organic farmers have access to organic information, while majority of the non-certified organic farmers (88.2 %) have access to organic information. On one hand, 54.3 % of conventional farmers have no access to organic information. Though access to organic information seems to be relatively low among conventional farmers, the general impression received is that organic information sources are available to the majority of the pineapple farmers in the region, since the majority of organic (97.5 %) and non-certified

organic farmers (88.2 %), respectively, have access to organic information, while a substantial amount of conventional farmers (45.7 %) also have access to organic information. As a result, the study went further to determine the sources of organic information. The responses are presented in the Figure 3.7 below. These results show that the main source of information to all the pineapple farmers is through farmers and farmer-based organisations.

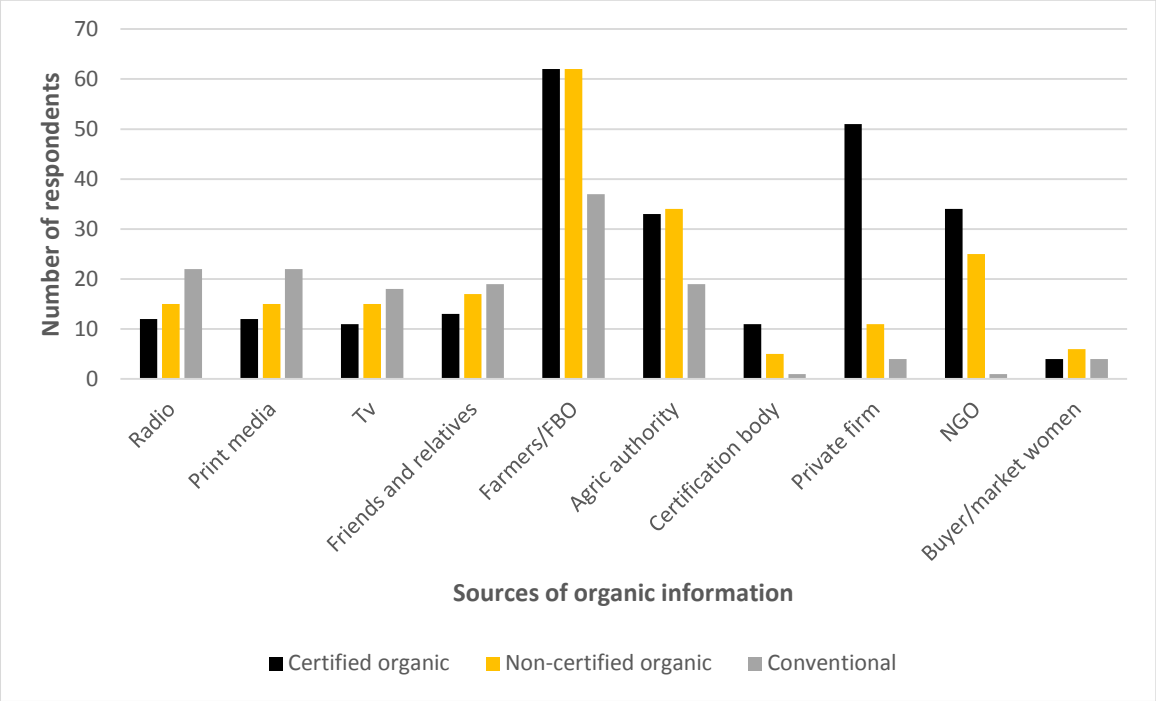

Figure 3.7: Distribution of organic information sources available to pineapple farmers

In terms of access to credit, the majority of all farmers had no access to credit, as shown in Table 3.6 below. However, 39.2 % of certified organic farmers accessed credit, only 28.9 % of the non-certified organic farmers had access to credit, and 30.7 % of the conventional farmers had accessed credit. The low access to credit is an indication that the pineapple farmers in the study area are credit constrained. The survey data reveals that access to credit is higher for certified organic farmers, followed by conventional farmers, and the lowest for non-certified organic farmers. In terms of access to subsidised input, 26.4 % of the conventional farmers had received input subsidies, while 16.5 % of the certified organic farmers have access to subsidised input. Only 13.2 % of the non-certified organic farmers obtained subsidy on inputs. The implication is that farmers have limited access to subsidised inputs. Also, all the certified organic farmers had adequate access to support services. Seventy-five per cent (75 %) of the non-certified organic farmers had access to support service, while only 26.4 % of the conventional farmers accessed support services.

Table 3.6: Pineapple farmers' access to credit, subsidised input and organisational support

Variable		Certified organic		Non-certified organic		Conventional	
		Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
Access to credit (Cred)	No	48	60.8	54	71.1	97	69.3
	Yes	31	39.2	22	28.9	43	30.7
Access to subsidised input (Chinp)	No	66	83.5	66	86.8	103	73.6
	Yes	13	16.5	10	13.2	37	26.4
Access to support services (Orgsup)	No	0	0	19	25.0	103	73.6
	Yes	79	100	57	75.0	37	26.4

The results in Table 3.6 above indicate that support service is an important factor associated with the adoption of certified organic production. Therefore, the study further asked farmers to specify the various support services they received. The responses are presented in Figure 3.8 below. Figure 3.8 shows that farmers receive support services, such as advisory services, certification, input, financial and linking farmers to available markets.

The certified organic farmers receive advisory services, certification and input support, but no financial and linking farmer to market support services. The non-certified organic farmers receive advisory services, input, financial and linking farmer to market services. However, they do not have access to certification. Conventional farmers also receive all the support services, with the exception of certification and financial support from organisations.

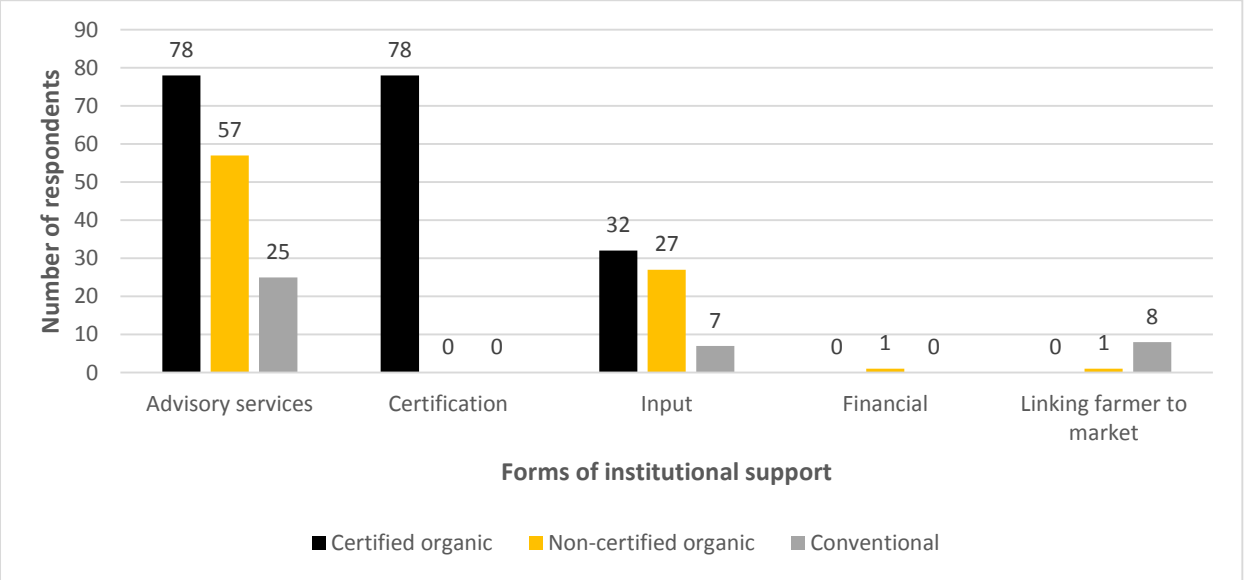

Figure 3.8: Forms of institutional support received by farmers

Having contracts with pineapple exporters or processors plays a significant role in pineapple farmers' choices of a production system, since exporters or processors have specific requirements that farmers are required to meet. Hence, the distribution of farmers who had contract arrangement with any certified organic pineapple exporter or processor was assessed and the results are presented in Figure 3.9 below. The survey data reveal that all the certified organic farmers had contract relationships with a certified organic company. For non-certified organic farmers, 56 had engaged in contracts with a certified organic company, while only three (3) conventional farmers had a contract agreement with a certified organic company which processes both certified and conventional pineapples.

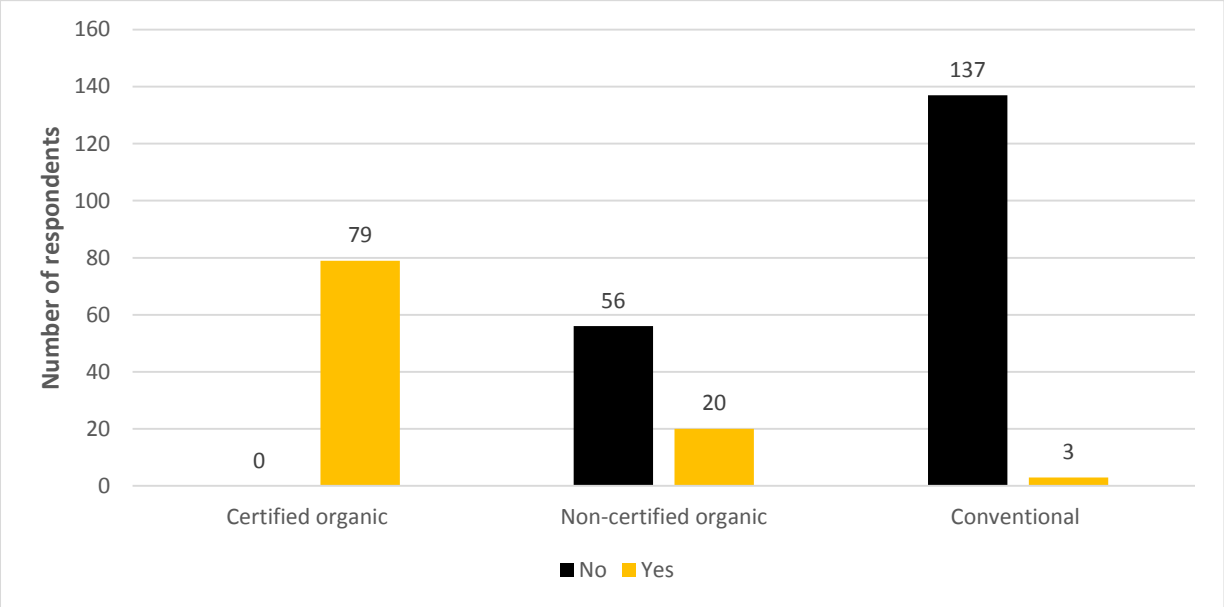

Figure 3.9: Distribution of farmers with contract relationships with a certified organic company (exporter or processor)

Access to extension, organic training and labour usage were important variables in the model. Table 3.7 below presents the descriptive statistics of the number of organic extension contacts received, numbers of organic training sessions attended since 2012, and the proportion of hired labour, measured as the total number of people hired during the 2012–2014 production season.

The average number of organic extension contacts received by certified organic farmers during the 2012–2014 pineapple production seasons was 2.58. The average number for non-certified organic farmers was 2.15, and that of conventional farmers was 0.79. This indicates that certified organic farmers received more organic extension services in the 2012–2014 production seasons, compared with non-certified organic farmers. The average number of

organic training sessions attended by farmers from the past three years (2012 to 2015) was 5.72, 3.62 and 0.44 for certified, non-certified, and conventional farmers, respectively. Certified organic farmers, as expected, had high attendance at organic training from 2012 to 2015.

Table 3.7: Descriptive statistics of farmers' extension contacts, organic training and proportion of hired labour used

Variable	Certified organic		Non-certified organic		Conventional	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Organic extension contact (Extco)	2.58	3.07	2.15	2.75	0.79	1.89
Organic training (Train)	5.72	6.56	3.62	4.04	0.44	2.05
Proportion of hired (%) labour used (Labtyp)	19.43	9.45	17.39	9.99	34.11	22.34

The average proportion of hired labour used for pineapple production during the 2012–2014 production periods was 19.43 % for certified organic farmers, 17.39 % for non-certified organic farmers, and 34.11 % for conventional farmers. In all, conventional farmers used a high proportion of hired labour followed, by certified organic farmers, and the least was used by non-certified organic farmers.

3.3.4 Social Capital

An important fact that was revealed in the literature is that social capital influences an individual farmer's decision, since it facilitates information exchange, mutual help and collective action (Grischow, 2008). As a result, the study investigated the social capital levels of pineapple farmers in the Central Region of Ghana. The social capital level of an individual is made up of cognitive (intangible) social capital and structural (tangible) social capital. According to Krishna & Shrader (2000), investigating levels of social capital should start with the analyses of the indicators of structural and cognitive social capital, independently. Thereafter, the two can be aggregated and analysed together.

Cognitive social capital

The levels of cognitive social capital for pineapple farmers was measured, based on the level (on a five-point Likert scale) to which respondents agreed with a number of statements that serve as proxies for cognitive social capital. The first step, when analysing the levels of

cognitive social capital, is to investigate the dimensions (indicators) underlying the cognitive social capital of pineapple farmers. The dimensions are investigated by means of factor analysis of the farmers' responses to the statements below (see Table 3.8 below). Thereafter, cognitive social capital indices are compiled for each individual farmer under each production system using the formula in Appendix B.

Based on the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (equal to 0.88), 19 of the original 30 questions were deemed to measure the same underlying aspect and were included in the factor analysis. The Bartlett test for sphericity was significant at 1 % (p=0.000), confirming that factor analysis would be useful. Using the Eigen-value criteria (Eigen-values less than 1 are excluded as a factor), five components had Eigen-values greater than one and explain 64.78 % of the variance in the farmers' responses to questions aimed at quantifying their levels of social capital (Appendix C). All of the variables that were included in the analysis have communalities greater than 0.5, and thus extracted factors explain in excess of 50 % of the variation in each of the variables that were included in the analysis. Varimax rotation was applied to ensure that each variable loaded high on as few factors as possible. The rotated matrix indicates that none of the variables loaded above 0.50 on more than one factor (component). Table 3.8 below presents the rotated component matrix showing the dimensions underlying social capital of pineapple producers from Central Region.

As shown in Table 3.8, the statements that loaded high on the first factor all seem to relate to farmers' quality association with people in their informal network and their commitment to those in the informal network. The factor was named 'informal associatedness', and has seven factors loading with an Eigen-value of 6.55. The statements that loaded high on the second factor related to trust in people and institutions in the immediate environment. This factor is named 'core trust' and has an Eigen-value of 1.95. Factor three shows support attitude of farmers to others in the community. This factor has an Eigen-value of 1.74 and was labelled 'support exchange'. Three factors loaded heavily on the fourth factor (Eigen-value of 1.06). The factor was labelled 'personal orientation', as it relates to a farmers' perception about his or her personality. The last factor relates to trust in organisations and a service provided by organisations, such as district agricultural officers and local government, (Eigen-value of 1.01). The fifth factor was called "organisational trust".

Table 3.8: Rotated component matrix to show the dimensions underlying social capital of pineapple producers from Central Region

	Component				
	Informal associatedness	Core trust	Support exchange	Personal orientation	Organizational trust
I get along well with my family	**0.679**	0.430	-0.074	0.111	0.046
I get along well with people in my community	**0.650**	0.400	-0.058	0.168	0.223
I get along well with other farmers	**0.741**	0.341	-0.014	0.126	-0.074
I participate actively in communal labour	**0.690**	0.055	-0.048	0.437	0.068
I will lend money to my neighbour if he/she needs it to see a doctor	**0.647**	-0.008	0.410	-0.047	0.199
I will support and contribute financially to community project that might not benefit me most, but benefit other villagers	**0.769**	0.056	0.129	0.011	0.176
I will contribute financially to my farmer group activities when need be	**0.761**	0.205	0.068	0.059	-0.019
I trust my family and friends	0.214	**0.727**	0.113	0.152	-0.018
I trust the church and its people	0.252	**0.753**	0.060	0.152	0.129
I trust other farmers	0.156	**0.722**	-0.002	0.165	0.330
I trust the legal system	0.192	**0.682**	0.032	0.093	0.186
I trust management of the pineapple processing or export companies	0.102	**0.709**	0.121	0.039	0.145
I have exchanged planting materials with other farmers in the past	0.104	0.033	**0.850**	0.161	0.121
I have engaged in mutual exchanges with other community members	0.005	0.170	**0.865**	0.109	-0.025
I am willing to forgo a profit opportunity in the short run for the ability to benefit from potential profit opportunities in the long run.	0.089	0.088	0.129	**0.711**	0.132
Generally speaking, do you agree most people could be trusted	-.026	0.410	-0.026	**0.601**	0.061
I participate actively in festivals and other Community groupings	0.292	0.099	0.223	**0.616**	0.057
I trust the district agricultural office and its policies towards agriculture	0.227	0.347	-0.031	0.146	**0.699**
I trust local government (traditional authorities) as agents of development	0.042	0.220	0.153	0.115	0.**835**
Eigen value	6.55	1.95	1.74	1.06	1.01
Cronbach's Alpha	0.88	0.84	0.78	0.52	0.66

a. Rotation converged in 6 iterations.

The descriptive statistics of farmers' scores for factors representing cognitive social capital per production system are presented in Table 3.9 below.

Table 3.9: Descriptive statistics of farmers' scores for factors representing cognitive social capital per production system

Social capital indicators	Certified organic	Non-certified organic	Conventional	Overall Mean
Informal associatedness	22.78	22.96	22.87	22.87
Core trust	10.50	10.65	10.40	10.52
Support exchange	1.34	1.42	1.30	1.35
Personal orientation	3.44	3.28	3.45	3.39
Organizational trust	1.32	1.44	1.39	1.38
Cognitive social capital	39.39	39.75	39.41	39.51

The values of the indicators that represent cognitive social capital were standardised to 50 and therefore range from zero to 50. A value of zero indicates no cognitive social capital, and a value of 50 indicates full cognitive social capital. When looking into more detail in the respective components of the cognitive social capital index shown in Table 3.9, one can see that the average scores for informal associatedness and core trust for certified organic, non-certified and conventional farmers are greater than 10, followed by the average score for personal orientations, which are 3.44, 3.28 and 3.45 for certified organic, non-certified organic and conventional, respectively. The next higher indicator score for certified organic farmers is support exchange, with organisational trust being the lowest, with a score of 1.32, while the next indicator for non-certified organic and conventional farmers is organisational trust, with the smallest being support exchange. This suggests that the cognitive social capital levels for all the pineapple farmer categories are mainly driven by the informal associatedness, and the levels to which they trust people and institutions in their immediate environment. Although the cognitive social capital for certified organic, non-certified organic and conventional pineapple farmers were driven by the same informal associatedness and core trust, the level of cognitive social capital is high for non-certified farmers (39.75), followed by conventional farmers with a score of 39.41, then the least is a score of 39.39 for certified organic farmers.

Structural social capital

The levels of structural social capital of pineapple farmers in the Central Region of Ghana were obtained by summing farmers' active participation in formal organisations. A value of two was given to those respondents who indicated that they are active members of the organisation, a value of one to inactive members, while non-members scored a value of zero. The structural social capital of the farmers is also standardised to a value of 50. A value of 50

indicates full structural social capital (an active member of all of the listed organisations), while zero indicates no structural social capital (non-member of all of the listed organisations). As shown in Table 3.10 below, the structural social capital is high among certified organic farmers (average score of 28.24), compared with non-certified organic (24.88) and conventional farmers (25.36).

Table 3.10: Descriptive statistics of farmers' structural social capital per production system

Formal organisation	Certified organic	Non-certified organic	Conventional	Overall Mean
Religious/church group	5.82	5.37	5.07	5.42
Political party/group	2.53	1.60	2.12	2.08
Farmers association	5.89	5.22	4.17	5.09
Local government	1.42	1.28	1.70	1.47
Farmers study group	4.95	4.56	3.68	4.39
Community committee	2.41	1.65	2.26	2.11
Funeral association	1.86	2.02	2.88	2.35
Informal savings/credit(susu group)	3.36	3.17	3.48	3.34
Structural social capital	28.24	24.88	25.36	26.16

When evaluating the respondents' participation in formal organisations in more detail (Table 3.9 above), for certified organic farmers, one can see that the average scores for members of farmers' associations and member of religious groups are the highest (5.89 and 5.82, respectively), followed by members of farmers' study groups (4.95), informal savings (3.36), political party (2.53), community committee (2.41), funeral association (1.86). Certified organic farmers were least (1.42) involved in local government. The high level of active participation by certified organic farmers in the farmers' association was expected since pineapple farmers who wants to be certified can only benefit economically (reduced cost) when they apply from group certification.

For non-certified organic farmers, the average score for member of a religious group (5.37) is the highest, followed by members of farmers' associations (5.22). The next participation in formal organisation by non-certified organic farmers is membership in farmers' study group (4.56), informal savings (3.36), funeral association (2.02), community committee (1.65), political party (1.60) and local government (1.28). Conventional farmers have the highest average score for member of religious group and members of farmers' association (5.07 and 4.17, respectively), followed by members of farmers study groups (3.68), informal savings (3.48), funeral association (2.88), community committee (2.26), political party (2.12) and local government (1.70).

Social capital index

The overall social capital index was calculated by adding the standardised cognitive social capital index to the standardised structural social capital index of the individual farmers (Appendix B). An overall social capital index of 100 thus implies full structural and cognitive social capital, while a value of zero would indicate no structural or cognitive social capital at all. Table 3.11 below shows the descriptive statistics of social capital index among pineapple farmers by production system. The average score for the overall social capital index for certified organic farmers was 67.63, which is higher than the overall social capital index for non-certified organic (64.63) and conventional farmers (64.76). Based on the results, the overall social capital index for all pineapple farmer categories seem to be relatively high, with all the farmer categories having a social capital index above the 50 midpoint used as benchmark for standardising both cognitive and structural social capital. This is consistent with the expected result, on the basis of social capital theory, and in particular the sense of togetherness and high level of association that exists among farmers in the farming communities in Ghana.

Table 3.11: Descriptive statistics of social capital among pineapple farmers by production system

Social capital	Certified organic	Non-certified organic	Conventional	Overall Mean
Structural social capital	28.24	24.88	25.36	26.16
Cognitive social capital	39.39	39.75	39.41	39.51
Social capital Index	67.63	64.63	64.76	65.67

3.3.5 Physical Factors

The physical environment that pineapple farmers operate in influences farmers' behaviour. As a result, the study investigated variables that relate to the farmers' physical environment. The section presents a discussion of these variables that include size of the pineapple farm, distance from farm to organic market, and access to certified organic market. Table 3.12 below provides summary statistics of the variables.

Central Region farmers mostly have access to small landholdings owing to the forms of tenure system that exist in the region. Table 3.12 above shows the average farm size for certified organic farmers to be 2.85 acres, which is smaller than that of non-certified organic farmers with average farm size of 3.22 acres. Conventional farmers cultivated larger pineapple farms (4.30 acres) than those in the other two production systems.

Table 3.12: Summary statistics on pineapple farmers farm specifics

Variable	Certified organic		Non-certified organic		Conventional	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Farm size (Fsize)	2.85	3.34	3.22	4.43	4.30	6.88
Distance from farm to organic market (Fdist)	0.92	0.46	36.04	22.64	95.51	38.35

Most production areas in the region are distant from the organic market; the average distance from certified organic farms to the nearest certified organic market is 0.92 kilometres, which is shorter than the distances from both non-certified organic and conventional farms. Comparing the distances of non-certified organic farms and conventional farms in Table 3.12, indicates that the conventional farm distance is 2.65 times the distance of non-certified organic farms. This indicates that organic production areas are closer to organic markets than conventional pineapple production areas are.

The survey data shows that most of the certified organic farmers (98.7 %) had access to organic markets, while only 1.3 % did not have access to organic markets, as illustrated in Figure 3.10 below. For the non-certified organic farmers, 68.4 % had access to organic markets. About 87.1 % of the conventional farmers had access to organic markets. The survey data demonstrates that access to organic markets is higher for certified organic farmers, but relatively lower for non-certified organic farmers.

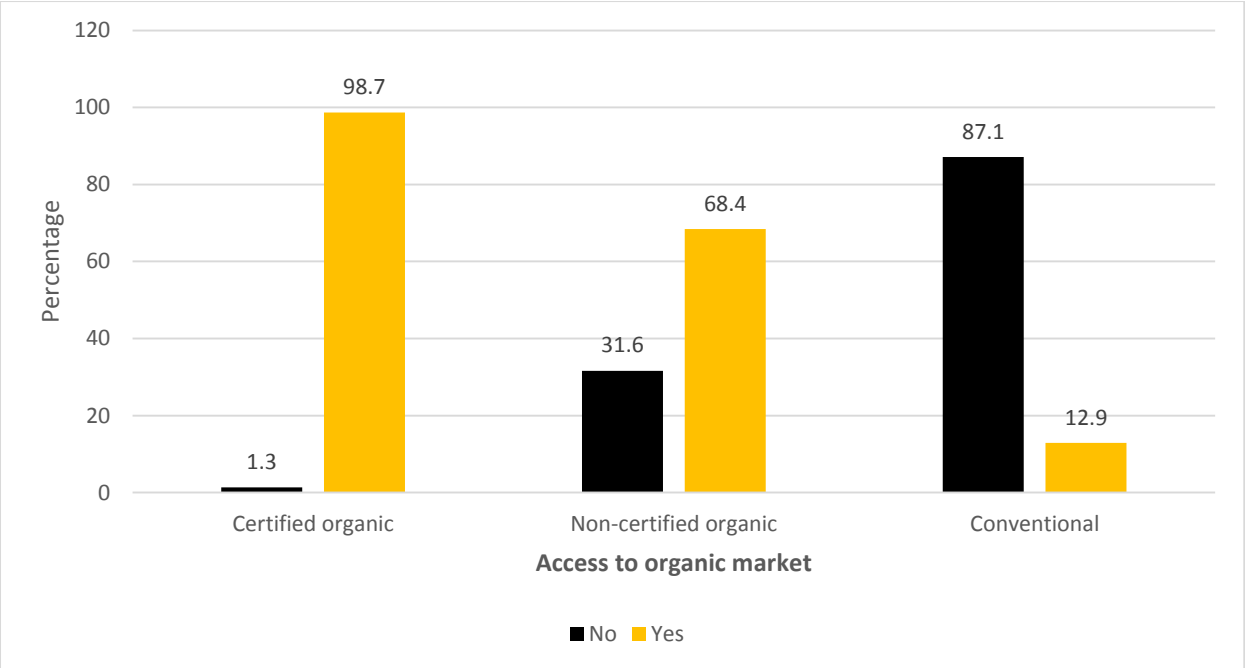

Figure 3.10: Distribution of farmers with certified organic market access

3.3.6 Institutional Factors

The production of pineapple is carried out in an institutional environment that has an influence on production activities and farmers' production behaviour. The various institutions identified by the study to exist in the pineapple industry in the Central Region of Ghana include land tenure regulations, organic standards and regulation, phytosanitary requirements for importing country, and traditional belief/taboos/norms. The four main tenure systems of pineapple farms identified in the study include tenure on own land, rented land, clan land and family land. The difference between the clan and family land is that the clan land belongs to the farmer's tribal group, whereas the family land belongs to the farmer's immediate extended family (mother, father and siblings), as shown in Figure 3.11 below.

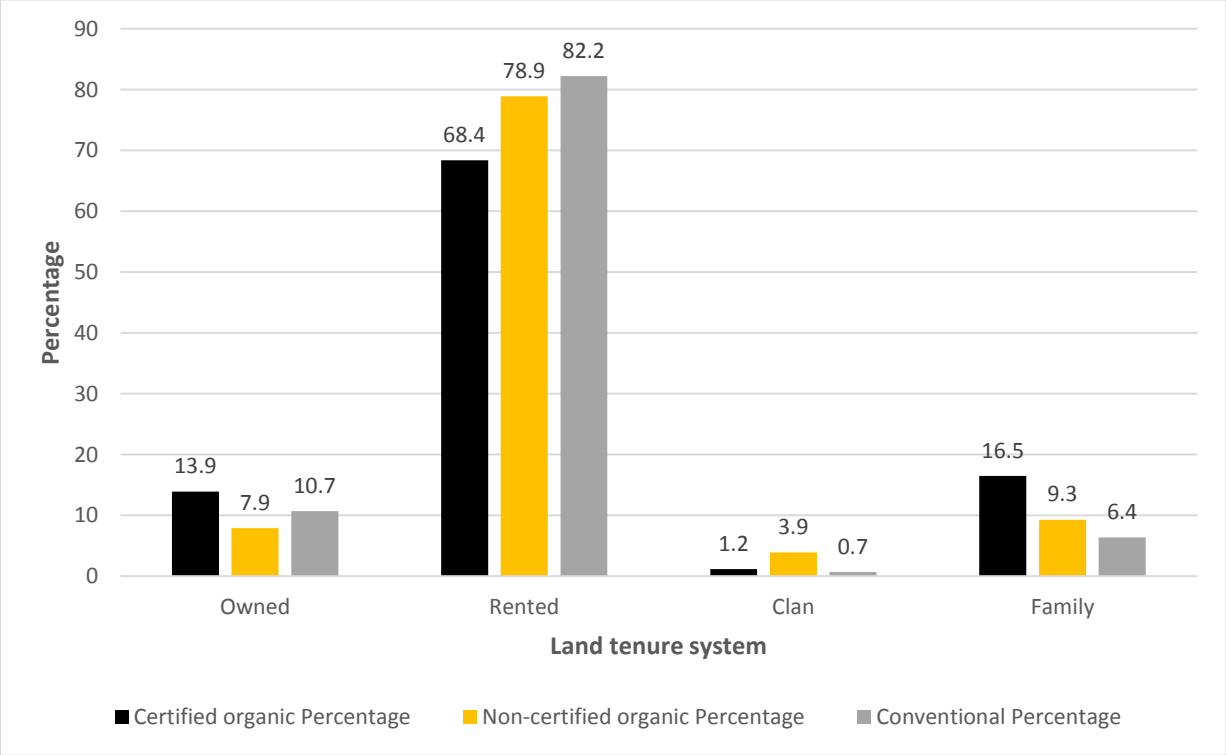

Figure 3.11: Land tenure systems distribution of pineapple farmers

Figure 3.11 above shows that the majority of all the categories of farmers use rented land for pineapple production. In the case of certified organic pineapple farmers, the next tenure system is family land (16.5 farmers) followed by owned land (13.9 farmers), with a few of the farmers using clan land (1.2 farmers) for pineapple production. Also, non-certified organic farmers have a tenure system of family land (9.3 farmers) followed by owned land (7.9 farmers), and the lowest being clan land (3.9 farmers) for pineapple production. Conventional farmers use an owned land (10.7 farmers) tenure system for their pineapple production.

The knowledge levels regarding institutions held by the farmers are presented in Table 3.13 below. The focus in Table 3.13 is on the knowledge of institutional variables that was included in the model. In terms of knowledge level of land tenure regulations, certified organic farmers had the large number of farmers (32.9 %) having high knowledge, followed by non-certified organic farmers (28.9 %), then the conventional farmers with 21.4 % of farmers having high knowledge. About 30.1 % certified organic farmers, 15.8 % non-certified organic farmers, and 10.0 % conventional farmers had high knowledge of organic standards and regulations.

Table 3.13: Distribution of pineapple farmers on the basis of knowledge regarding institutions in the Ghanaian pineapple industry

Institution	Knowledge Category	Certified organic		Non-certified organic		Conventional	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Land tenure regulations (KLTRS)	No	19	24.1	22	28.9	26	18.6
	Low	6	7.6	7	9.2	12	8.8
	Medium	28	35.44	25	32.9	72	51.4
	High	26	32.9	22	28.9	30	21.4
Organic standards and regulation (KORS)	No	17	21.5	17	22.4	66	47.1
	Low	8	10.1	12	15.8	13	9.3
	Medium	30	37.97	35	46.05	47	33.57
	High	24	30.4	12	15.8	14	10.0
Phytosanitary requirements (KPhyto)	No	37	46.8	53	69.7	84	60
	Low	5	6.3	7	9.2	13	9.3
	Medium	28	35.5	14	18.4	30	22.2
	High	9	11.4	2	2.6	12	8.8
Traditional belief/taboos/ norms (KTrad)	No	7	8.86	6	7.89	26	18.57
	Low	38	48.10	40	52.63	63	45
	High	34	43.0	30	39.5	51	36.4

About 11.4 % of certified organic farmers had high knowledge of the phytosanitary requirement for importing country and 8.8 % of conventional farmers had high knowledge of the phytosanitary requirement for importing country. Only 2.6 % of non-certified organic farmers had high knowledge of the phytosanitary requirement for importing country. All the farmer categories had very low percentages of the farmers having high knowledge of the phytosanitary requirement for importing country. This might be associated with the fact that most of the surveyed farmers are not exporters. Pineapple farmers' knowledge of traditional belief/taboos/norms was high. About 43.0 %, 39.5 % and 36.4 % of the certified organic, non-certified organic and conventional pineapple farmers, respectively, had high knowledge of traditional beliefs/taboos/norms in the Central Region of Ghana that influences production activities.

3.3.7 Summary of Respondents' Characteristics

The descriptive characteristics of the respondents revealed that three production systems exist in the Central Region of Ghana. These are certified organic, non-certified organic and conventional systems of pineapple production. The majority of the farmers were conventional pineapple producers, followed by those following a certified organic production system. Non-certified pineapple producers were the least in numbers. Most of the farmers in all the categories were males, and married. Among all the categories of production systems, basic education was the highest attained level of education. Most of the farmers in all categories engage in off-farm activities. The pineapple farmers were found to be in their middle ages. The results show that pineapple farmers in all the categories have positive perceptions towards the financial and institutional aspects of certified organic pineapple production. All the certified organic farmers have received organic training. Most of the non-certified organic and conventional farmers had received training on their production practices. The majority of certified organic and non-certified organic farmers have access to organic information. However, most conventional farmers have no access to organic information. Most of the farmers in all the production systems have no access to credit and subsidised inputs. All the certified and non-certified organic pineapple producers have access to support services. All certified organic farmers have written contracts with certified organic companies, while the conventional farmers had no contracts. Non-certified organic farmers had high cognitive social capital, while certified organic farmers had the lowest cognitive social capital. Conventional farmers had the highest social capital index, followed by certified organic farmers, with the non-certified organic farmers having the lowest social capital index. Most of the certified and non-certified organic farmers have access to organic markets. Most of the production systems are operated under rented land tenure system.

The next section sets out the method used to identify and characterise the certified, non-certified and conventional production systems and the method used to measure the influence of various factors on choice of a pineapple production system in Ghana.

3.4 Procedures

3.4.1 Identify and Describe the Characteristics and Requirements of the Different Production Systems in the Pineapple Production Sector

The identification and description of the characteristics and requirements of the different pineapple production systems was carried out using qualitative and quantitative description.

The qualitative and quantitative descriptions of the pineapple production and marketing using the different production systems were arrived at through the application of part of the integrated VC-NIE-SCP framework of Jordaan *et al.* (2014). The integrated VC-NIE-SCP framework was used as the benchmark because of its potential to enable the researcher to do a comprehensive analysis of the pineapple value chain for the various production systems under consideration. The framework entails the examination of the three levels of pineapple value chain (influencers, players and supporters) in four interrelated levels of the sector (social embeddedness level, institutional environment-structure level, governance structure-conduct level, and resource allocation-performance level).

The information on available production systems was first obtained, followed by information on specific characteristics of the interrelated levels. The information was obtained from farmers, extension agents, agricultural directors and heads of organisations, such as GEPA in charge of pineapple exports, certification bodies and the GSB, the horticulture and PPRSD departments of MoFA, through the use of focus group discussions, key informant interview and a structured questionnaire. The information enabled the analysis of each of the four interrelated levels of the framework.

The social embeddedness level and the institutional environment-structure level were used to examine the value chain influencers of each production system. The level of social embeddedness of farming communities and farmers was analysed using social capital theory. The measurement of the level of social capital was based on the statement relating to trust, optimism and satisfaction, reciprocity, networks and social participation and membership in organisations. The features of institutional environment-structure level considered were formal institutions available to farmers using a particular production system and farm and market characteristics, such as number of farmers in the region using the production system, the average size of farms, the distribution of farm sizes, the different systems of land ownership and tenure, types of markets that are available, location of input and output markets, market infrastructure, and the different marketing channels.

The analysis of the value chain players was done by describing the governance structure-conduct level and resource allocation-performance level of the framework. First, the actors within a production system who are directly involved with moving pineapple from the input suppliers to the final consumers were identified. Based on the focus of the study, the analysis of the pineapple value chain players was concentrated on farmers' behaviour. In terms of governance structures, the focus was on transactions between the pineapple producers and traders in a production system. Characteristics were also used to describe the value chain

player, such as sources and availability of credit, sources and availability of market information, the method of price formation, investment in technical training and services, the behaviour of the traders in the market, the level of competition in the market, the types of contracts that are employed, and the marketing strategies. The description of the value chain players of each production system concluded with information on resource allocation and performance of the farmers. The focus of the research did not consider testing the efficient structure hypothesis that has been used as an indicator of agricultural market performance in various researches, but does comment on the volumes and sales of pineapple.

The last stage of the application of the integrated VC-NIE-SCP framework was the analysis of value chain supporters. The value chain supporters of each of the identified production systems were only considered as to the extent of their behaviour in supporting pineapple farmers. The discussion of the support structures was limited to sources of support services and type of support service provided by individuals or organisations to the pineapple farmers under the different production systems.

The application of the integrated VC-NIE-SCP framework in characterising the different production systems ensured that the production systems were comprehensively described at all the three levels: the actors who are involved with moving pineapples from the input suppliers to the final consumer; the social, physical and institutional environments that influence the behaviour of the value chain players; and the support structures that are available to support the pineapple farmers to operate within the environment that was created by the influencers. The description of the characteristics and requirements of each production system identified was presented systematically, following the levels of the integrated VC-NIE-SCP framework.

3.4.2 Factors that Influence Farmers' Choice of Pineapple Production System in Ghana

The second objective was to determine and analyse the factors that influence farmers' choices of a particular pineapple production system in Ghana. A quantitative approach was employed to determine the magnitude and direction of influence of the social, physical and institutional factor and other factors on farmers' choice of a certified organic pineapple production system from among non-certified organic and conventional production systems. A multinomial logit model was used to determine the factors that influence the pineapple farmers' decisions whether to use a certified organic, a non-certified organic, or a conventional pineapple production system. The binomial logit or probit models which are widely used in analysing

adoption were not chosen for this study because the binomial logit or probit models are designed to analyse the choice between two alternatives, for instance if farmers have only two production systems to choose from, i.e. “conventional” or “organic”. However, in quantitative choice modelling, Rigby, Young & Burton (2001) and Greene (2000) have argued that when the dependent variable has three alternatives for respondents to choose from, then the researcher should consider a multinomial or ordered probit models. The use of the ordered probit model is applicable where there exists an ordered or logical ordering of the alternatives. Thus, it is assumed that there exists an underlying latent variable that drives the choice between the alternatives (Verbeek, 2008). Duration analysis techniques are sometimes used when the dependent variable involves more than two alternatives (Radwan *et al.,* 2011).

The duration analysis approach is appropriate if the researcher wishes to account for right censoring and to easily handle time-varying covariates. Duration analysis allows for overcoming the limitation arising from considering farm characteristics previous to the sample period or at the time of starting as the unique determinant of farm survival over time (Radwan *et al.,* 2011). The multinomial logit is preferred when the alternatives of the dependent variables are not ordered or in logical sequence, and also when the timing of adoption is not a focus for the researcher (Rigby *et al*., 2001; Green, 2000; Radwan *et al.,* 2011). Hence, the multinomial logit model is appropriate for this study, given the nature of this sample, where it is postulated that the pineapple producer has three production choices: (i) conventional pineapple production system (ii) non-certified organic pineapple production system (iii) certified organic pineapple production system. Where there are multiple choices, the multinomial logit model is more appropriate.

3.4.2 Empirical Specification of Multinomial Logit Model

According to Green (2000) and Radwan *et al.* (2011), if there are three alternatives to choose from, the model takes the form:

$$\Pr(y=i)=\frac{e^{X\beta(i)}}{e^{X\beta(1)}+e^{X\beta(2)}+e^{X\beta(3)}}\quad i=1,2,3 \tag{1}$$

However, as the β (i) coefficients cannot be identified uniquely, Maddala (1992) and Green (2000) proposed that some arbitrary restriction is required. The usual approach is to set one set of coefficients to 0, for instance if option one is set to 0, then

$$\Pr(y=1)=\frac{1}{1+e^{X\beta(2)}+e^{X\beta(3)}} \tag{2}$$

It is worth noting that, the base category (1) is chosen but the predicted probabilities for y = 1, 2, and 3 are independent of the choice of restriction (Burton, *et al.,* 1999). The relative probability of y = 2 to the base category is:

$$\frac{\Pr(y=2)}{\Pr(y=1)} = e^{X\beta(2)} \tag{3}$$

Specifically to this study, the base category is taken to be the set of conventional pineapple producers and the study seeks to investigate whether the characteristics of the certified organic pineapple producers are significantly different in a statistical sense from those of the non-certified organic pineapple producers, or indeed from those of conventional producers. The pineapple production system choice model concerns the decision made by farmer *i,* $i = 1, 2, ..., I$ of the alternative *j* in the set $w_i = (1, ..., j)$ which produces the highest utility level (V_{ij}). Thus, $V_{i1} \leq V_{ij}, \forall\, j \in w_i$ in this notation indicates the choice set is allowed to vary across individual pineapple producers to account for their own specific production systems available.

The pineapple production system choices 1, 2 and 3 denote conventional the pineapple production system, the non-certified organic pineapple production system, and the certified organic pineapple production system, respectively. The conventional pineapple production system is chosen as base category (option 0) since it is the mainstream production system. The utilities of other pineapple production systems (certified organic and non-certified organic pineapple production system) are compared to that of the base category. The individual decision is based on the differences between utility derived from the other production systems and the base category. This can be represented as $Y_{ij}^* = V_{ij} - V_{1j}$, where Y_{ij}^* denotes unobservable choice made. $Y_i = j$ if individual *i* makes choice *j*. If $Y_{ij}^* < 0$ for *j* = 1,…, J, then farmer *i* chooses the base category option (conventional pineapple production system) and $Y_i = 0$. Otherwise, farmer *i* makes a choice which yields the highest value for Y_{ij}^* and $Y_{ij} = j$. Assuming that each farmer *i* faces the same *J* alternatives, a multinomial logit model is specified as:

$$\mathrm{Y}_{ij} = \sum_{i}^{j} \beta_j PC_{ij} + \sum_{i}^{j} \lambda_j ABF_{ij} + \sum_{i}^{j} \alpha_j SC_{ij} + \sum_{i}^{j} \delta_j PF_{ij} + \sum_{i}^{j} \gamma_j IF_{ij} + \mu_i \tag{4}$$

Where Y_{ij} is the dependent variable, the personal characteristics of farmers is represented by $\sum_{i}^{j} \beta_j PC_{ij}$ where PC_{ij} is a (*1 x K*) vector of personal variables characterising both alternative

j and the individual *i.* β is a (*K x 1*) vector of fixed parameters to be estimated for the personal characteristics, *K* is the number of personal characteristics. $\sum_{i}^{j}\lambda_j ABF_{ij}$ represents the attitudinal and behaviour factors, where ABF_{ij} is a *(1 x K)* vector of attitudinal and behavioural variables characterising both alternative *j* and the individual *i.* λ is a (*K x 1*) vector of fixed parameters to be estimated for the attitudinal and behavioural factors. $\sum_{i}^{j}\alpha_j SF_{ij}$ represents the Social factors, where SF_{ij} is a *(1 x K)* vector of social variables characterising both alternative *j* and the individual *i.* α is a (*K x 1*) vector of fixed parameters to be estimated for the social factors. The physical factors are represented by $\sum_{i}^{j}\delta_j PF_{ij}$ in the model, where PF_{ij} is a (*1 x K*) vector of physical variables characterising both alternative *j* and the individual *i.* α is a (*K x 1*) vector of fixed parameters to be estimated for the physical factors. The institutional factor is represented by $\sum_{i}^{j}\gamma_j IF_{ij}$ in the empirical model, where IF_{ij} is a (*1 x K*) vector of institutional variables characterising both alternative *j* and the individual *i.* γ is a (*K x 1*) vector of fixed parameters to be estimated for the institutional factors.

Substituting the personal characteristics, attitudinal and behavioural factors, social factors, physical factors and institutional factors hypothesised to influence farmers' choice of certified organic pineapple production from among other production systems, such as non-certified organic and conventional production, will result in the empirical multinomial logit model specified in equation (5)

$$\begin{aligned} Y_{ij} = {} & \beta_o + \beta_1 \text{Educ} + \beta_2 \text{Fexp} + \beta_3 \text{HHsize} + \beta_4 \text{Off-f} + \beta_5 \text{Finc} + \beta_6 \text{Wea} + \lambda_7 \text{Envcon} + \lambda_8 \text{Comperc} \\ & + \lambda_9 \text{Preperc} + \lambda_{10} \text{Certperc} + \lambda_{11} \text{Profperc} + \lambda_{12} \text{Labtyp} + \lambda_{13} \text{Cont} + \lambda_{14} \text{Extco} + \lambda_{15} \text{Train} \\ & + \gamma_{16} \text{Infoav} + \lambda_{17} \text{cred} + \lambda_{18} \text{Chinp} + \gamma_{19} \text{Orgsup} + \alpha_{20} \text{Scap} + \delta_{21} \text{Fsize} + \delta_{22} \text{Mavail} \\ & + \delta_{23} \text{Fdist} + \gamma_{24} \text{Lten} + \eta_{25} \text{KLTSR} + \varphi_{26} \text{KOSR} + \chi_{27} \text{KPhyto} + \pi_{28} \text{KTrad} + \mu \end{aligned} \quad (5)$$

Dependent Variable in the Multinomial Logit Model

The dependent variable in the multinomial logit model which examines the factors that influence the decision of pineapple producers for choosing a certified organic production

system from among non-certified organic and conventional production systems in Ghana is the available production systems. The dependent variable is a multiple choice as to whether the pineapple producers use conventional, non-certified organic and certified organic production systems. The use of the conventional production system was used as the base category. The choice of a production system was determined by means of a structured questionnaire in which pineapple producers were asked to indicate the production system they are using from the three available productions and marketing alternatives.

$$Y = \begin{cases} 1 \ if, \ certified \ organic \ production \ system \\ 2 \text{ if}, \ non\text{-}certified \ organic \ production \ system \\ 0 \ if, \ conventional \ production \ system \end{cases} \quad (6)$$

Explanatory variables in logistic regressions of farmers' choice of production system

This section defines and discusses the explanatory variables hypothesised to influence Ghanaian pineapple farmers' choice of certified organic pineapple production from among non-certified and conventional production systems. The section explains why the variables are expected to have the hypothesised signs, how the variables were measured, and the definition for the variables. The variables were categorised into personal characteristics (*PC*), attitudinal and behavioural factors *(ABF)*, social factors (*SF*), physical factors (P*F*) and Institutional (*IF*). Table 3.14 below shows the variables used and the measurement index, as well as the expected direction of influence of the factors.

Table 3.14 shows the five categories of variables hypothesised to influence pineapple farmers' choice of a certified organic production system from among non-certified and conventional production systems. The personal characteristics hypothesised to influence the choice of certified organic production system include education (Educ), pineapple farming experience (Fexp), household size (HHsize), and farmers' involvement in off-farm activity (Off-F), farm income (FInc) and wealth of farmer (Wea). The expected influence of the variables education (Educ) on the pineapple farmers' choice of certified organic production system is either positive or negative because education might encourage the acceptance of new farming practices by lowering learning costs, or it may discourage adoption by providing more profitable off-farm employment opportunities to the farmers.

The influence of pineapple farming experience (Fexp) on the choice of a certified organic production system is indeterminate because experienced farmers have adequate knowledge and skills in pineapple production that will make it easier for them to adopt new practices. On

the other hand, less experienced pineapple farmers are idealistic and less risk averse, which renders them willing to take on the risk of adopting new practices.

Table 3.14: Description of explanatory variables hypothesised in the model to influence pineapple farmers' choice of certified organic production system

Variable definition	Variable description	Expected signs
Personal Factors		
Educ	Educational level of farmers. Dummy variable: 0 if no formal education (Noformal_Educ), 1 if basic school (Basic_educ), 2 if Senior secondary school (SSS_Educ), 3 if training college (Training_Educ), 4 if undergraduate university education (Undergrad_Educ)	+/-
Fexp	Pineapple farming experience in years	+/-
HHsize	Household size. Number of household members who can work on the farm.	+
Off-F	Farmer's involvement in off-farm activity. 1 if the farmer is involved in off-farm activity, 0 otherwise	+/-
FInc	Farm income. Proportion of annual income from farming in GH¢	+
Wea	Wealth of farmer. Value of total number of assets own (durable goods) own by a farmer in GH¢	+
Attitudinal and Behavioural Factors		
Envcon	Environmental and health concern. 1 if not concerned (Not_Envcon), 2 if concerned (Con_Envcon), 3 if highly concerned (High_Envcon)	+
ComPerc	Perceived compatibility of previous production to certified organic production. 1 if farmer agrees previous production is compatible, 0 otherwise	+
PrePerc	Perception of premiums for organic product. 1 if farmer agrees organic products attracts high premium, 0 otherwise	+
CertPerc	Perceived high cost of certification. 1 if farmer agrees organic certification is high, 0 otherwise	-
ProfPerc	Perceived profitability of certified organic production. 1 if farmer agrees organic production is profitable, 0 otherwise	+
Labtyp	Type of labour used. Proportion of hired labour to total labour used on pineapple farm per farming season	-
Cont	Contract with certified organic pineapple exporters or processors. 1 if farmer has contract with exporters or local processing companies, 0 otherwise	+
Extco	Extension contact. The number of extension contact per production season	+
Train	Training on organic production**.** The number of organic production training sections a farmer has attended for the past three years	+
Infoav	Availability of organic production and marketing information. 1 if farmer have access to organic information source, 0 otherwise	+
Cred	Credit access. 1 if farmer have easy access to credit, 0 otherwise	-
Chinp	Subsidised chemical input. 1 if farmer have access to subsidised synthetic inputs and 0 otherwise.	-
Orgsup	Access to support services from governmental or NGOs. 1 if farmer have access to support services, 0 otherwise	+

Table 3.14 Description of explanatory variables hypothesised in the model to influence pineapple farmers' choice of certified organic production system (Continued)

Variable definition	Variable description	Expected signs
Social Factors		
Scap	Social capital. Social Capital index (1-100)	+
Physical Factor		
Fsize	Farm size in acres	-
Mavail	Certified organic market availability and access. 1 if farmer has access market, 0 otherwise	+
Fdist	Distance of farm to market in kilometres	-
Institutional Factor		
Lten	Type of land tenure system, Dummy variables. 1 if farm land is from family (Family_Lten) 0 otherwise, 1 if farm land is rented (Rent_Lten), 0 otherwise, 1 if farm land is owned (Own_Lten), 0 otherwise	-
KLTRS	Level of knowledge on land tenure system: 1 if farmer has no knowledge (LTSR_no_knowl) on land tenure systems, 0 otherwise. 1 if farmer has low knowledge on land tenure systems (LTSR_low_knowl), 0 otherwise. 1 if farmer has medium knowledge (LTSR_medium_knowl) on land tenure systems, 0 otherwise. 1 if farmer has high knowledge (LTSR_high_knowl) on land tenure systems, 0 otherwise.	+/-
KOSR	Level of knowledge on organic standards and requirement: 1 if farmer has no knowledge (OSR_no_knowl) on organic regulations and standards, 0 otherwise. 1 if farmer has low knowledge (OSR_low_knowl) on organic regulations and standards, 0 otherwise. 1 if farmer has medium knowledge (OSR_medium_knowl) on organic regulations and standards, 0 otherwise. 1 if farmer has high knowledge (OSR_high_knowl) on organic regulations and standards, 0 otherwise.	+/-
KPhyto	Level of knowledge on phytosanitary regulations: 1 if farmer has low knowledge (Phyto_low_knowl) on phytosanitary regulations, 0 otherwise. 1 if farmer has medium knowledge (Phyto_medium_knowl) on phytosanitary regulations, 0 otherwise. 1 if farmer has high knowledge (Phyto_high_knowl) on phytosanitary regulations, 0 otherwise.	+/-
KTrad	Level of knowledge on taboos or norms: 1 if farmer has no knowledge (Trad_no_knowl) on traditions, 0 otherwise. 1 if farmer has low knowledge (Trad_low_knowl) on traditions, 0 otherwise. 1 if farmer has high knowledge (Trad_high_knowl) on traditions, 0 otherwise.	+

Farmer engagement in off-farm activity (Off-F) is expected to have either positive or negative influence on pineapple farmers' choice of a certified organic production system. This is because off-farm employment can discourage the adoption of certified organic production by reducing the hours needed to attend to a management-intensive practice. Off-farm activities may encourage adoption by providing extra financial resources that will enable farmers to invest in certified organic production.

Household size (HHsize) is expected to have positive influence because family labour is a main source of labour to farming households in Ghana and as such, a larger household size is an indication of availability for organic production which is known to be labouring intensive. Farm income (FInc) is expected to have a positive influence on pineapple farmers' choice of a certified organic production system. Farmers with higher annual agricultural incomes have the purchasing power to cover the additional cost and so facilitate the adoption of certified organic production. Wealth of farmer (Wea) is expected to positively influence pineapple farmers' choice of a certified organic production system. The reason being that wealthier farmers have greater access to resources and may be able to invest in technologies, more than those with low income can.

The attitudinal and behavioural factors hypothesised to influence the choice of a certified organic pineapple production system include environmental and health concern (Envcon), perceived compatibility of current production with certified organic production (ComPerc), perception of premiums for organic product (PrePerc), perceived high cost of certification (CertPerc), perceived profitability of certified organic production (ProfPerc), type of labour used (Labtyp), contracts with exporters or processors (Cont), extension contacts (Extco), training on organic farming (Train), availability of information on organic production and marketing (Infoav), credit access (Cred), subsidised chemical input (Chinp), and access to support services from government or NGOs (Orgsup). Table 3.14 above shows that environmental and health concern (Envcon), perceived compatibility of current production with certified organic production (ComPerc), perception of price premiums for certified organic product (PrePerc), and perceived profitability of certified organic production (ProfPerc) are expected to positively influence the choice of a certified organic production system. The reason for these hypotheses is that farmers who have a positive perception of certified organic production system will be more likely to adopt certified organic production. Perceived high cost of certification (CertPerc) is expected to influence the choice of certified organic production negatively. Type of labour used (Labtyp) is hypothesised to have a negative influence on the choice of a certified organic production system. The more the hired labour use is, the higher the production cost of certified organic production will be, because organic production is labour intensive.

Contracts with certified organic pineapple exporters or processors (Cont) are expected to influence the choice of a certified organic production system positively because contracts provide a farmer with an assured certified organic market. Extension contacts (Extco) are hypothesised to have a positive influence because farmers who have contacts with extension agents, who are experienced and knowledgeable, are privileged and are expected to adopt

certified organic production systems. Training on organic farming (Train) is expected to have positive influence because training on organic production improves the human capital of farmers which enables them to adopt management-intensive practices.

Availability of information on organic production and marketing (Infoav) is expected to positively influence the choice of a certified organic production system. The reason is that the availability of production and marketing information sources reduces transaction costs of certified organic production. Credit access (Cred) is expected to impact negatively because lack of access to credit in a form of inputs or cash will prevent farmers from purchasing synthetic inputs. Subsidised chemical input (Chinp) is expected to negatively influence the choice of certified organic production system. Favourable agricultural policies, such as subsidised chemical inputs without considering including organic inputs, is said to favour conventional production systems. Access to support services from government or NGOs (Orgsup) is expected to positively influence the choice of a certified organic production system. Support services to small-scale farmers serve as an incentive for adopting certified production systems.

From the table, the social variable hypothesised to influence choice of certified organic production is the Social capital (Scap) level of farmers. Social capital is hypothesised to positively influence the choice of certified organic pineapple production. Social capital is positive because support services from governmental organisations and NGOs and certification in Ghana is mostly done in groups. Farmers with higher levels of social capital are expected to more frequently attend such collective sessions and to trust and relate better to other farmers.

The physical factors specified in the model to influence the choice of a certified organic production system include farm size (Fsize), certified organic market availability and access (Mavail), and distance of farm to market (Fdist). Farm size (Fsize) is expected to influence the choice of a certified organic production system negatively. Small farm size will make it easier for farmers to manage organic farms because certified organic production is more extensive. Market availability and access (Mavail) is hypothesised to have a positive influence on the choice of a certified organic production system. The reason is that the availability of a certified organic production system is an indication of market demand for certified organic products, which serves as incentive to farmers. Distance from farm to market (Fdist) is hypothesised to have a negative influence on the choice of certified organic production system. The longer the distance from the farm to organic market is, the higher the transaction cost will be.

The Institutional factor hypothesised to influence the choice of certified organic production system is the type of land tenure system (Lten) experienced on the pineapple farms and knowledge on various institutions in the Ghanaian pineapple sector that will influence the adoption certified organic production such as land tenure system and regulations (KLTRS), organic standards and regulations (KOSR), phytosanitary requirement (KPhyto) and taboos or norms (KTrad). The various institutions were identified through key informant interviews with individuals that are heads of organisations in the pineapple industry and were more knowledgeable on pineapple production and marketing. The degree to which pineapple farmers have knowledge on these institutions is expected to contribute positively to the adoption of certified organic pineapple production. The Type of land tenure system (Lten) is expected to have a negative influence because the rights that farmers have over natural resources, such as land, can be important in determining whether they take a short- or long-term perspective in managing resources.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter presents the results of the analyses that were performed to meet the objectives of the study, as well as a discussion of the results. The chapter is divided into two sections. The results concerning the characteristics and requirements of the different pineapple production systems used by pineapple farmers are discussed in the first section. This section includes a discussion of characteristics and requirements of certified organic pineapple production and marketing, non-certified organic pineapple production and marketing, and conventional pineapple production and marketing. The second section presents a discussion of the factors within the social, physical and institutional enviroments influencing farmers' choices between certified organic, non-certified organic, and conventional production systems for pineapple production.

4.1 Characteristics and requirements of the different pineapple production systems in the pineapple production sector

This section identifies the different production systems used for pineapple production in the Central Region of Ghana and applies the integrated VC-NIE-SCP framework to describe the characteristics and requirements of the identified production systems. Through the application of the framework, pineapple production and marketing for the different production systems are examined at the macro- (value chain influencers), micro- (value chain players) and meso- (value chain supporters) levels. More specifically, the section focuses on describing the social (social embeddedness), institutional and physical (farm and market structure) environment within which the respective pineapple farmers operate; the behaviour (governance structures and conduct) and performance of the respective pineapple farmers and other actors within their social, physical and institutional environments; and the support structures (governance structures and conduct) that are available to the respective pineapple farmer categories to overcome production and marketing challenges and thus successfully operate in the social, physical and institutional environment. It is important to note that the region's cultural norms and traditions will be the same for all the farmers and will be discussed once. However, the social embeddedness level of the categories of farmers is assessed quantitatively, using social capital theory. Also, it is important to note that some institutions influence all the production

systems, while others are specific to a particular production system. The strictness of adhering to the various institutions depends on the target market (export or domestic market).

The study identified three different production systems adopted by pineapple farmers in the Central Region of Ghana. The three main systems for producing and marketing pineapples were the certified organic, non-certified organic and conventional production systems. Accordingly, the section presents a description of the characteristics and requirements of certified organic, non-certified organic and conventional pineapple production systems.

4.1.1 Characteristics and requirements of certified organic pineapple production and marketing at the Central Region of Ghana

This section presents a description of the characteristics and requirements of certified organic pineapple production and marketing base on the three levels of value chain analysis. In the first level, certified organic value chain influencers describe the social capital level of the certified organic farmers, structure of certified organic farms, markets, formal and informal rules and regulations (requirements) that influence the way actors within the certified organic pineapple value chain behave. The value chain players, who form the second level of analysis, represent the actors who are directly involved in moving organic certified pineapples from the input suppliers to the end consumers. Furthermore, the way in which the actors conduct production and marketing activities and the performances of the actors are analysed under the value chain players' level. The last level of analysis, the value chain supporters, examines the forms of support received by certified organic farmers, together with the organisations that provide the supports.

4.1.1.1 Value chain influencers

4.1.1.1.1 Social Embeddedness (Level 1 of VC-NIE-SCP)

Social embeddedness refers to customs, traditions and societal norms that affect the behaviour of the economic agents under consideration. The norms and values of the people in the Central Region of Ghana serve as an informal constraint on the behaviour of pineapple farmers in the region. The social embeddedness of certified organic farmers is assed first by describing the cultural norms and traditions in the Central Region.

- **Cultural norms and traditions in the region**

Communities in the Central Region reflect a typical Ghanaian society which, as Grischow (2008) argues, centres on collective action networks, trust, social cohesion and inclusion. The traditional Ghanaian society is organised around kinship groups and collectivist communities, in which the clan and extended family play an indispensable role in creating norms, values, and behavioural conduct acceptable to the society. This means that social groups, trust, interpersonal relations and ties which are aspects of social capital are rooted in the traditions and culture of people in the Central Region. Communities in the region have a vast number of groupings that promote trust, love and sense of belonging as a core value of the people. People, from infanthood, form collective groups, such as play groups, which enable them derive joy and share food with one another. Other numerous sub-community groupings such as drumming groups, funeral associations, community defenders' groups and house of royal elders are core norms in all communities in the Central Region. This shows that there is a high level of communal spirit in the region. An example is the long-standing tradition of communal labour, organised at least once a week, in all communities in the region. Traditional leaders in the various communities encourage and promote communal spirit and collective action as a tool for community development. As a result of these groupings, trust among members is high, with each individual benefiting from the trustworthiness of others in the group. The interpersonal relationships among members in a social organisation in the region are highly emotional and cherished, to the extent that the needs of the social group are valued over those of the individual.

Many benefits are available within and among these groupings to members and the society. In some farming communities, communal spirit among farmers leads to collective action that enables them to manage pooled resources. For instance, labour groups (e.g. "Nnoboa" group) are formed among poor farmers to enable them to get access to shared labour pool at no cost during the main farming season. Indigenous rotating-credit societies (e.g. 'susu' funds) are also formed by farmers and traders to enable them gain access to credit (Adjargo, 2012). Another collective act developed by farmers is the mobilisation of funds which involves a daily contribution of money to individual savings collectors (susu collectors) for a month, which they return at the end of the month, minus one day's amount as a commission. The success of the functioning of these networks in farming communities has been found to be based on the level of trust among the farmers in the network.

The norm of collective action can, however, degenerate into chaos if the trust in the groups or network is betrayed. Although farmer groups are strong in the region because of their history

of successful collective actions, recent developments show that some farmers have withdrawn from their groups (Grischow, 2008). This has, with time, resulted in a reduced level of trust among members in a group. The lack of trust among farmers and traders has implications on production and marketing activities in the region. This is because a certain amount of trust is always involved in transactions and collective actions. According to Darrah (2015), weak trust towards individuals in a group hinders pooled resource management and information dissemination, as well as training of farmers by extension officers, in the region.

The above discussion shows that the social embeddedness (social capital) of the pineapple farmers in the region is expected to influence their choice of pineapple production system. As a result, the study did not take social embeddedness level of farmers as given, but rather investigated it in detail. The next section presents the social capital levels of certified organic pineapple farmers.

- **Social capital of certified organic farmers**

Given the social environment within which the certified organic farmers operate, the social embeddedness of the farmers is expected to influence certified organic pineapple production and marketing. The social embeddedness level of certified organic pineapple farmers is assessed by analysing the social capital level of the farmers. Social capital is a good proxy for assessing social embeddedness level, because it refers to individuals' levels of trust, networks and norms. Figure 4.1 below sets out a cumulative probability function of the overall social capital indices for certified organic pineapple farmers. The average score for the overall social capital index was 67.63, and is relatively higher than the 50 midpoint. Figure 4.1 shows that the minimum social capital index achieved by a certified organic pineapple farmer is about 24.68, while the highest index was 88.47. The high level of social capital is good, because trust and collective action has an important role in the certification of small-scale farms in the Central Region of Ghana. Although certified organic pineapple farmers cultivate and manage their farms independently, the farmers have to come together as a group to obtain organic certification. Also after certification, farmers have to trust other members in the group to adhere to the rules and regulations in order to maintain their group certificate.

The high social capital is an indication that certified organic farmers trust one another and they get along well. The role of collective action and trust in the social capital of the farmers leads to the conclusion that the social embeddedness of certified organic farmers is expected to influence their behaviour.

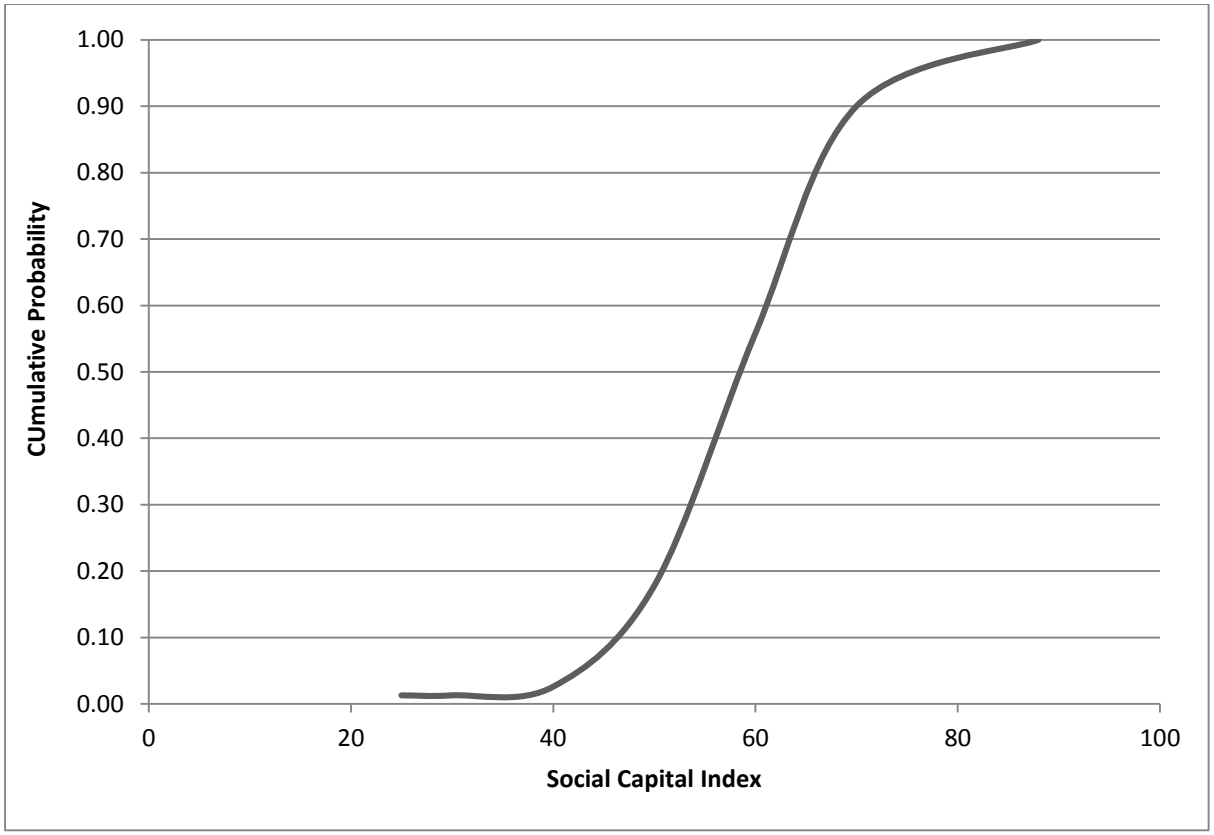

Figure 4.1: Cumulative probability distribution of the overall social capital indices of certified organic pineapple farmers

The next section gives a description of the structure of certified organic farms and market (physical environment), and of the rules and regulations (institutional environment) that influence the behaviour and performance of certified organic pineapple farmers.

4.1.1.1.2 Institutional Environment and Structure (Level 2 of VC-NIE-SCP)

The institutional environment and structure level of the integrated VC-NIE-SCP framework is concerned with the physical and institutional environment within which the certified organic farmers operate. The structure component is comprised of average size of certified organic farms, distribution of land among certified organic farmers, the land ownership and tenure of certified organic farms, the different types of markets available to certified organic farmers and actors in the markets, and the location of input and output markets. The institutional environment contains all the formal and informal rules and regulations that influence the way in which certified organic farmers behave within the value chain. The institutional environment influences the structure, and similarly, the structure is also influenced by rules and regulations that are specified in the institutional environment.

4.1.1.2 Value chain players

The certified organic pineapple value chain players include all actors in the value chain who are involved in moving the pineapple produced by the farmers from the production area to the end consumers. Figure 4.2 below shows a schematic representation of the product flow of certified organic pineapple from input suppliers to end buyers. The actors of the certified organic pineapple value chain are organic input suppliers, farmers, exporters, processors, market women, retailers and consumers (See Figure 4.2). Farmers producing within the certified organic pineapples value chain comprise three categories, namely small-scale, medium-scale and large-scale producers. The small-scale producers are farmers who cultivate from 0.5 acre to about 7 acres of land, the medium-scale farmers cultivate from 7.1 acres to about 14 acres, and the large-scale producers cultivate lands above 14 acres. The pineapple produced by these categories of farmers is all absorbed into marketing channels in the local markets. There are four main supply channels on the domestic market, namely the organic market, market women, processors, and exporters. They also take on risks associated with storage, transport and related finances. Farmers have the option to choose the type of marketing channel for marketing their pineapples. In the organic market, the farmers sell their pineapple as “certified organic” directly to organic consumers. Market women (wholesalers and retailers) trading in pineapples purchase certified organic pineapple at the same price as conventional pineapple. Market women make the fresh pineapple readily available on roadsides and in open markets. The majority of the farmers who choose to sell to processors and exporters have formal contract arrangements with processing or exporting companies. Farmers gain a price premium on the organic pineapple that they sell to the exporters, but only receive the price premium after the pineapple has been sold on the export market. Exporters of certified organic pineapples only purchase fruit that meet export quality requirements. They also take on risks associated with storage, transport and related finances. Certified organic pineapples that are below export requirement are sold to local and international processors. The pineapples are processed into fresh cut, fruit salad, dried pineapple and juice for export markets and urban consumers on the local market. The EU organic niche markets and large-scale supermarkets are the main distribution channels in the export market for fresh and processed certified organic pineapples.

For the purpose of this study, the pineapple farmers in the certified organic value chain are of major importance as value chain players. Next, the focus of attention is to discuss the behaviour of the value chain players.

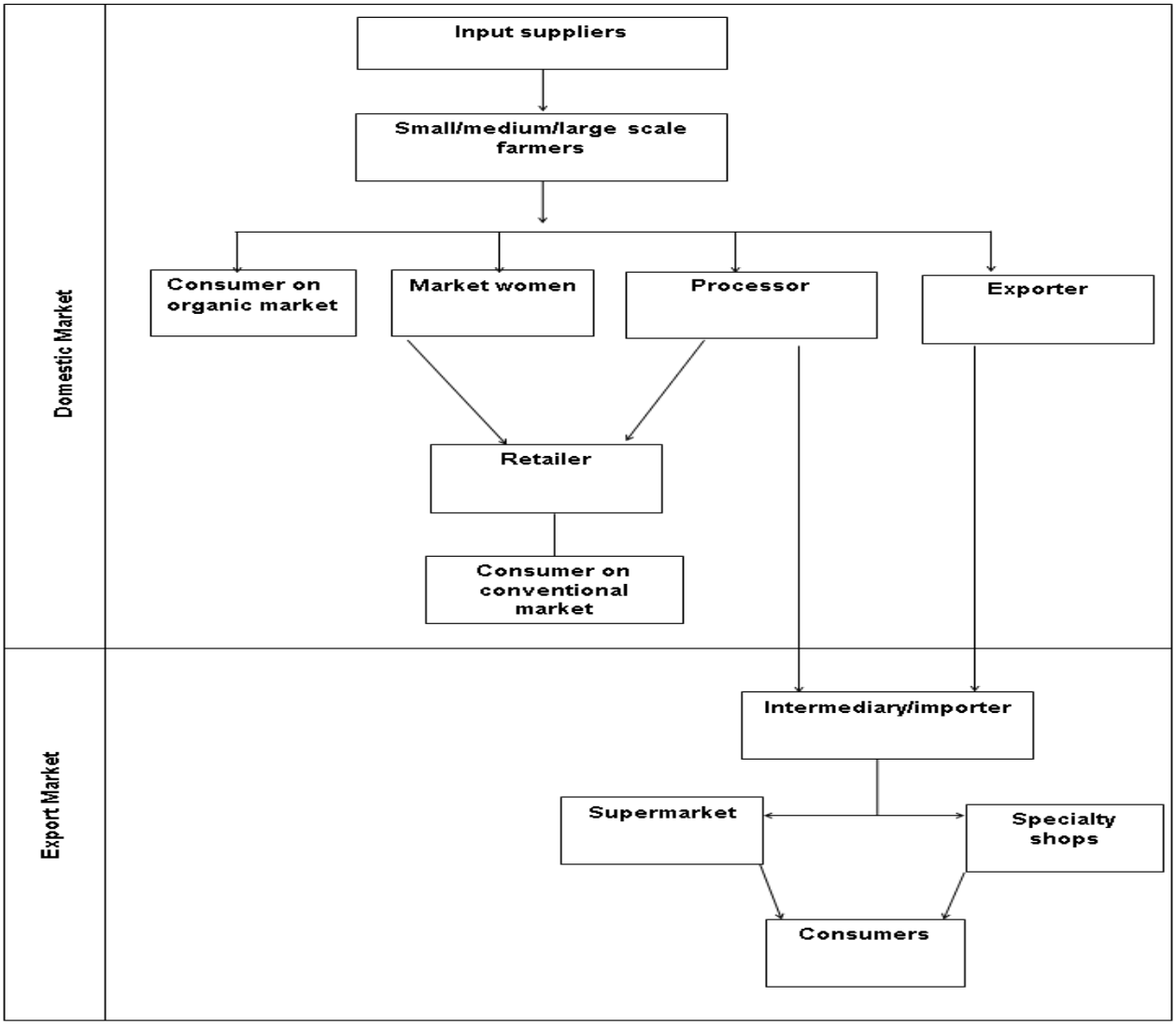

Figure 4.2: Schematic representation of the flow of certified organic pineapple from input suppliers to end buyers

4.1.1.2.1 Governance structures and Conduct (Level 3 of VC-NIE-SCP)

This level of the VC-NIE-SCP framework assesses the governance structures that are used to enforce the rules and regulations for the value chain players, as well as the behaviour (conduct) of value chain players within the farm and market structure. This section identifies the governance structures associated with the transactions between certified organic pineapple farmers and pineapple traders in the Central Region, as well as the production and marketing behaviour of certified organic farmers. The behaviour of certified organic farmers is concerned with the production practices used by farmers, the sources and availability of credit for funding production activities, the sources and availability of market information and the method of price formation. Also, the investment in technical training, the behaviour of the traders in the market, the level of competition in the market, the types of contracts that are

employed, and the marketing strategies being used by certified organic farmers are aspects of conduct that are discussed in this section.

- **Governance structure**

Certified organic farmers currently employ two types of governance structure when marketing their organic pineapple. The first type of arrangement is the spot market, where farmers can sell their pineapples to any wholesaler (middleman), processing company and exporter in the region. The second is a hybrid form of governance where farmers can enter into a contractual relationship with the pineapple processing or exporting company that operates in the region. Selling through a contract arrangement means that the farmer and the contract company or exporter create a binding oral or written contract, where a proportion of harvest is committed to the company or processor at an agreed price, as and when the company needs the quantities of pineapples agreed on. The company or exporter is seen as the first buyer of the certified organic farmers output, before the rest of the pineapples can be spot marketed. Next is a discussion of the performance of certified organic production, which concludes the description of the value chain players.

4.1.1.2.2 Resource allocation and Performance (Level 4 of VC-NIE-SCP)

Resource allocation and performance is the fourth level of the VC-NIE-SCP framework. At the resource allocation and performance level, production and market performance of certified organic production is evaluated with special reference to the actual quantity or volumes produced, sales and quality of certified organic fruit produced. Table 4.1 presents the statistics on the volume, price and sales of certified organic pineapples produced during the 2012/2014 production season. The study captured total pineapple harvested from 2012 to 2014 because the cultivation of pineapple from land preparation to harvesting of slips takes two years.

Table 4.1 below shows that the average quantity of certified organic pineapple produced during the 2012–2014 production season was 16 484.91kilograms per acre. The minimum quantity of pineapples obtained by certified organic farmers is 5 240 kilograms per acre, while the maximum obtainable pineapple yield is 31 756.76 kilograms per acre. The average volume of certified organic pineapple produced is lower than the volume of pineapple harvested on a one-acre conventional pineapple farm. Although the average yield per acre obtained from a certified organic farm is lower or the same as the average obtainable pineapple yield from a conventional farm, the quality of the certified organic pineapple is high (Darrah, 2015). This is because certified organic pineapples have longer shelf life.

Table 4.1: Summary statistics of output and sale of certified organic pineapple for the 2012/2014 production season

Variable	Unit	Mean	Minimum	Maximum
Quantity	kg/acre	16 484.91	5240.00	31756.76
Price	GH¢/kg	0.68	0.50	1.00
Total sales	GH¢/acre	9990.37	2625.00	24848.48

The price received by certified organic farmers for 1 kg pineapple ranges from GH¢ 0.50 to GH¢ 1.00. The price that certified organic farmers receive for their pineapple is in two forms and it is based on the choice of marketing channel. The price for selling a 1 kg organic pineapple through an organic marketing channel is 31–42 % higher than the price for selling organic pineapple through a conventional marketing channel. However, certified organic markets are not readily available to farmers, leading to a high volume of certified organic pineapple produced being sold through conventional marketing channels. This results in the average price received for certified organic pineapple being almost equal to the average price received by conventional farmers during the 20012–2014 production season. On average, a 1 kg certified organic pineapple costs approximately GH¢ 0.68 per kg. However, this price is higher than the price received by conventional farmers for a 1 kg conventional pineapple. The higher price may to a certain extent compensate for the lower pineapple volumes obtain from certified organic farms.

It can be seen in Table 4.1 above that the total sales from certified organic pineapple for an acre of land range from GH¢ 2 625.00 to GH¢ 24 848.48, with the average being GH¢ 9 990.37 per acre. Owing to the price premium received by organic farmers, the maximum sales of certified organic pineapple obtained for the 2012–2014 production season are higher than the maximum sales received by conventional farmers.

The description of the characteristics of certified organic production is concluded by describing the value chain supporters that support the farmers to be able to produce and supply certified organic pineapple to both local and export markets. The description of certified organic value chain supporters is presented in the next section.

4.1.2 Characteristics and requirements of Non-certified organic pineapple production and marketing at the Central Region of Ghana

This section presents a description of the characteristics and requirements of non-certified organic pineapple production and marketing base on the three levels of value chain analysis.

In the first level, value chain influencers of a non-certified organic production system comprise the social capital level of the farmers, structure of non-certified organic farms, and markets and institutions (requirements) that influence the way in which non-certified organic farmers behave. The value chain players, being the second level of analysis, presents the actors who are directly involved in moving organic-certified pineapples from the input suppliers to the end consumers. Also, the way in which the actors conduct production and marketing activities, and the performances of the actors are analysed under this second level. The last level of analysis, which is the value chain supporters, describes the forms of support received by non-certified organic farmers and the organisations that provide the support.

4.1.2.1 Value chain influencers

4.1.2.1.1 Social Embeddedness (Level 1 of VC-NIE-SCP)

The social embeddedness level of non-certified organic farmers is expected to influence their production and marketing behaviour. The social embeddedness level of non-certified organic pineapple farmers is assessed by analysing the social capital level of the farmers.

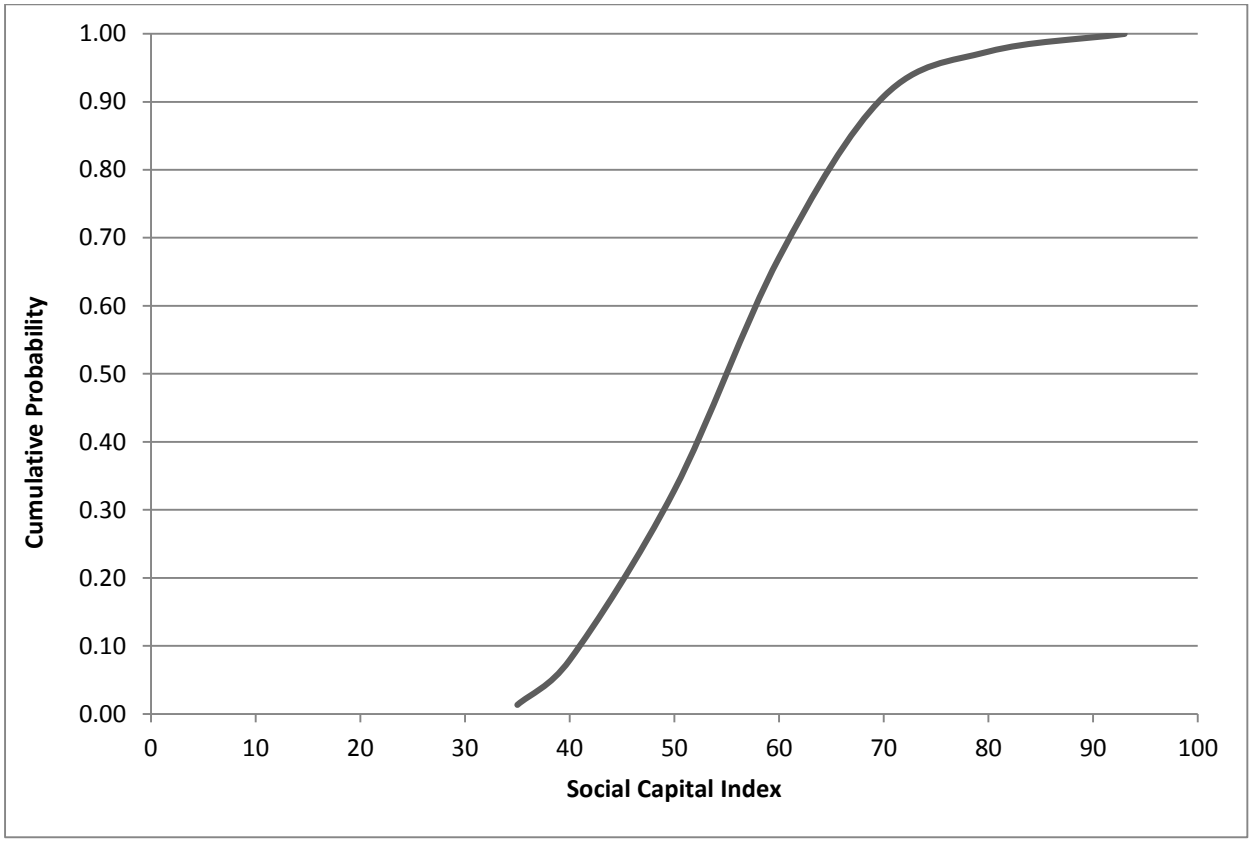

Figure 4.3: Cumulative probability distribution of the overall social capital indices of non-certified organic pineapple farmers

Figure 4.3 below presents a cumulative density function of the overall social capital indices for non-certified organic pineapple farmers. As seen in Figure 4.3, the average score for the overall social capital index was 64.62, and is relatively higher than the 50 midpoint. The minimum social capital index for non-certified organic pineapple farmers was 35.01, while the highest index was about 92.83. The scores show that the level of social capital is relatively high for non-certified organic farmers. The high social capital is an indication that non-certified organic farmers have high levels of trust, get along well with people in the community, and are involved in collective actions.

The next section gives a description of the physical (farms and market) and institutional environment that also influences the behaviour and performance of non-certified organic pineapple farmers.

4.1.2.1.2 Institutional Environment and Structure (Level 2 of VC-NIE-SCP)

The institutional environment and structure level of the integrated VC-NIE-SCP framework is concerned with the physical and institutional environment within which the non-certified organic farmers operate. The structure component is comprised of average size, non-certified organic farms, distribution of land among non-certified organic farmers, the land ownership and tenure of non-certified organic farms, the different types of markets available to non-certified organic farmers and actors in the markets, and the location of organic input and output markets. The institutional environment contains all the formal and informal rules and regulations that influence the way in which non-certified organic farmers behave within the value chain. The institutional environment influences the structure and similarly, the structure is also influenced by rules and regulations that are specified in the institutional environment.

4.1.2.2 Value chain players

The non-certified organic pineapple value chain players include all actors in the value chain who are involved in moving the organic pineapples produced by the farmers from the production area to the end consumers. Figure 4.4 below shows a schematic representation of the flow of non-certified organic pineapple from input suppliers to end buyers. The actors of the non-certified organic pineapple value chain are input suppliers, farmers, processors, wholesalers (middlemen), retailers and consumers. Figure 4.4 shows that fresh non-certified organic pineapples are produced by two categories of farmers, namely small-scale producers and medium-scale commercial producers. Non-certified organic pineapples are all marketed through supply channels on the domestic markets, with the exception of a few processed, non-

certified organic pineapples. The three main supply channels available to non-certified organic farmers on the domestic market are organic markets, middlemen and processors. In the organic market, the farmers sell their pineapple as “organic” directly to organic consumers. Middlemen (wholesalers and retailers) trading in pineapples purchase certified organic pineapple at the same price as conventional pineapple. Middlemen make the fresh pineapple readily available on roadsides and in open markets. They take on risks associated with storage, transport and related finance, and sometimes provide farmers with credit for production.

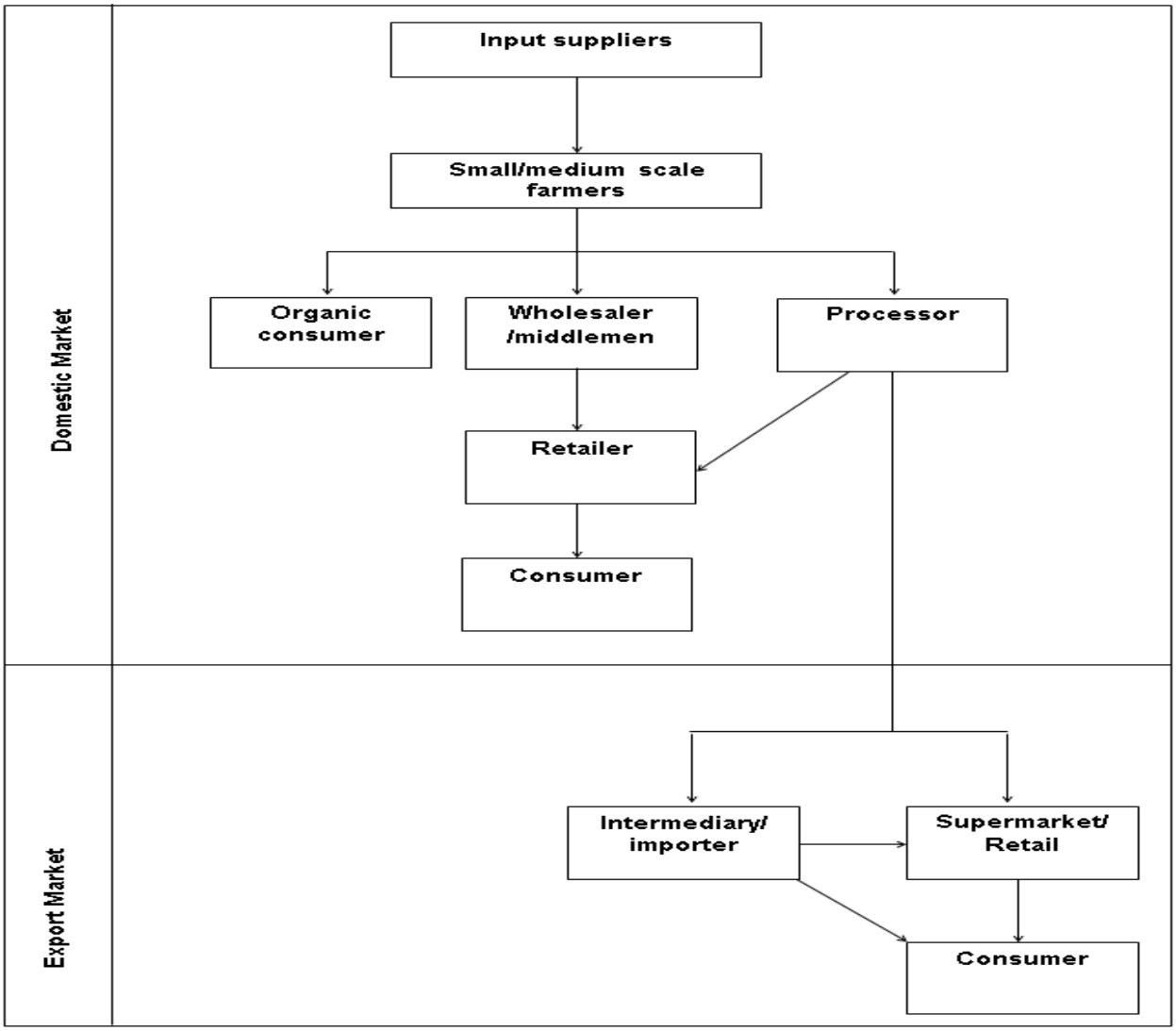

Figure 4.4: Schematic representation of the flow of non-certified organic pineapple from input suppliers to consumers

The majority of farmers have no formal relationships (i.e. contracts) with processing companies, but a few export companies spot buy (spot markets) from non-certified organic farmers during shortages to supplement their organic pineapple requirement needed for

export. The processing companies process pineapple into fresh cut, fruit salad, dried pineapple and juice products, and distribute to the domestic and export markets. In the domestic market, processed pineapple is distributed to urban consumers through middlemen. In the export market, processed pineapple is distributed to large supermarkets and other retail outlets.

For the purpose of this study, the non-certified organic farmers are of major importance as value chain players. Next, the focus of attention shifts to the behaviour of the value chain players.

4.1.2.2.1 Governance structures and Conduct (Level 3 of VC-NIE-SCP)

This section identifies the governance structures associated with the transactions between non-certified organic pineapple farmers and pineapple traders in the Central Region, as well as the production and marketing behaviour of non-certified organic farmers. The governance structures that are used to enforce the rules and regulations for the value chain players, as well as the behaviour (conduct) of value chain players within the farm and market structure, comprise the third level of the VC-NIE-SCP framework. The behaviour of non-certified organic farmers is concerned with the production practices used by farmers, the sources and availability of credit for funding production activities, the sources and availability of market information, and the method of price formation. Furthermore, the investment in technical training, the behaviour of the traders in the market, the level of competition in the market, the types of contracts that are employed, and the marketing strategies being used by non-certified organic farmers are aspects of conduct that are discussed in this section.

- **Governance structure**

There are three governance structures by which non-certified organic farmers distribute their harvest for marketing purposes. The first arrangement is the spot market, where farmers can sell their pineapples to any wholesaler (middlemen), processing company and consumers in the organic markets. The second arrangement is a hybrid form of governance where farmers can enter into a contractual relationship with a pineapple processing or exporting company that operates in the region. The contractual arrangement between non-certified organic farmers and their buyers or contractors is by oral binding contract. The contract only states that the farmer will sell farm output first to the processing company when needed, and after that, sell the surplus to other buyers. The next section discusses the performance of non-

certified organic production systems, which concludes the description of the value chain players.

4.1.2.2.2 Resource allocation and Performance (Level 4 of VC-NIE-SCP)

Resource allocation and performance comprise the fourth level of the VC-NIE-SCP framework. The production and marketing performance of non-certified organic production systems, such as the actual quantity or volumes or organic pineapple produced and sold, and quality of non-certified organic fruit produced are evaluated at this level of the VC-NIE-SCP framework. Table 4.2 below presents the statistics on the volume, price and sales of non-certified organic pineapples produced during the 2012–2014 production season. The study captured total pineapple harvested from 2012 to 2014, because the cultivation of pineapple from land preparation to harvesting of slips takes two years.

Table 4.2: Summary statistics of output and sale of non-certified organic pineapple for the 2012–2014 production season

Variable	Unit	Mean	Minimum	Maximum
Quantity	kg/acre	15 559.40	4 550.00	33 432.84
Price	GH¢/kg	0.76	0.5	1.75
Total sales	GH¢/acre	9 251.38	2 800.00	21 492.54

Table 4.2 shows that the average quantity of non-certified organic pineapple produced during the 2012–2014 production season was 15 5559.40 kilograms per acre. The minimum quantity of pineapples obtained by non-certified organic farmers was 4 550.00 kilograms per acre, while the maximum obtainable pineapple yield was 33432.84 kilograms per acre. The average volume of organic pineapple produces by non-certified organic pineapple farmers is lower than the volume of pineapple harvested on a one acre certified organic pineapple farm. Darrah (2015) and Pikins (2015) argue that the quality of the non-certified organic pineapple in the region is similar to the quality of certified organic pineapples. This is because the production practices followed by certified and non-certified organic farmers are the same.

The price received by non-certified organic farmers for a 1 kg pineapple ranges from GH¢ 0.50 to GH¢ 1.75. The price that non-certified organic farmers receive for their pineapple is also in two forms and it is based on the choice of marketing channel. The price for selling a 1 kg organic pineapple through an organic marketing channel is 31–42 % higher than the price for selling organic pineapple through a conventional marketing channel. Furthermore, the

average price for non-certified organic pineapple is higher (0.76) than the average price received by certified organic farmers. This is because the majority of the non-certified organic farmers do not have contracts with a certified organic company, and as a result, they target local organic markets. At the local organic markets, the non-certified organic farmers obtain higher prices, since they sell at retail price and directly to organic consumers. The higher price may to a certain extent compensate for the lower pineapple volumes obtained from non-certified organic farms.

It is seen in Table 4.2 above that the total sales per acre obtained by non-certified organic pineapple farmers range from GH¢ 2 800.00 to GH¢ 21 492.54, with the average being GH¢ 9 251.38 per acre.

4.1.3 Characteristics and requirements of conventional pineapple production and marketing in the Central Region of Ghana

The characteristics and requirements of conventional pineapple production and marketing are described at three levels. Social embeddedness of conventional farmers, structure of conventional pineapple farms, markets, and formal and informal rules and regulations (requirements) that influence the way in which actors within the conventional pineapple value chain behave are discussed as value chain influencers. The value chain players comprise the actors who are directly involved in moving conventional pineapples from the input suppliers to the end consumers. The value chain supporters comprise the organisations that provide support services to conventional organic farmers to successfully operate in the environment that is created by the value chain influencers.

4.1.3.1 Value chain influencers

4.1.3.1.1 Social Embeddedness (Level 1 of VC-NIE-SCP)

Social embeddedness level of the conventional farmers refers to the level of trust, networks and norms among the farmers. The social embeddedness level of conventional pineapple farmers is assessed by analysing their social capital level. Figure 4.5 below shows a cumulative density function of the overall social capital indices for conventional pineapple farmers.

The average score for the overall social capital index was 64.76, and is relatively higher than the 50 midpoint. Figure 4.3 shows that the minimum social capital index for conventional pineapple farmers was 34.55, while the highest index was 97.59. However, all the categories

of farmers have some form of social capital, which indicates that conventional farmers also exhibit some level of trust and get along with people in their community, as do certified and non-certified organic farmers.

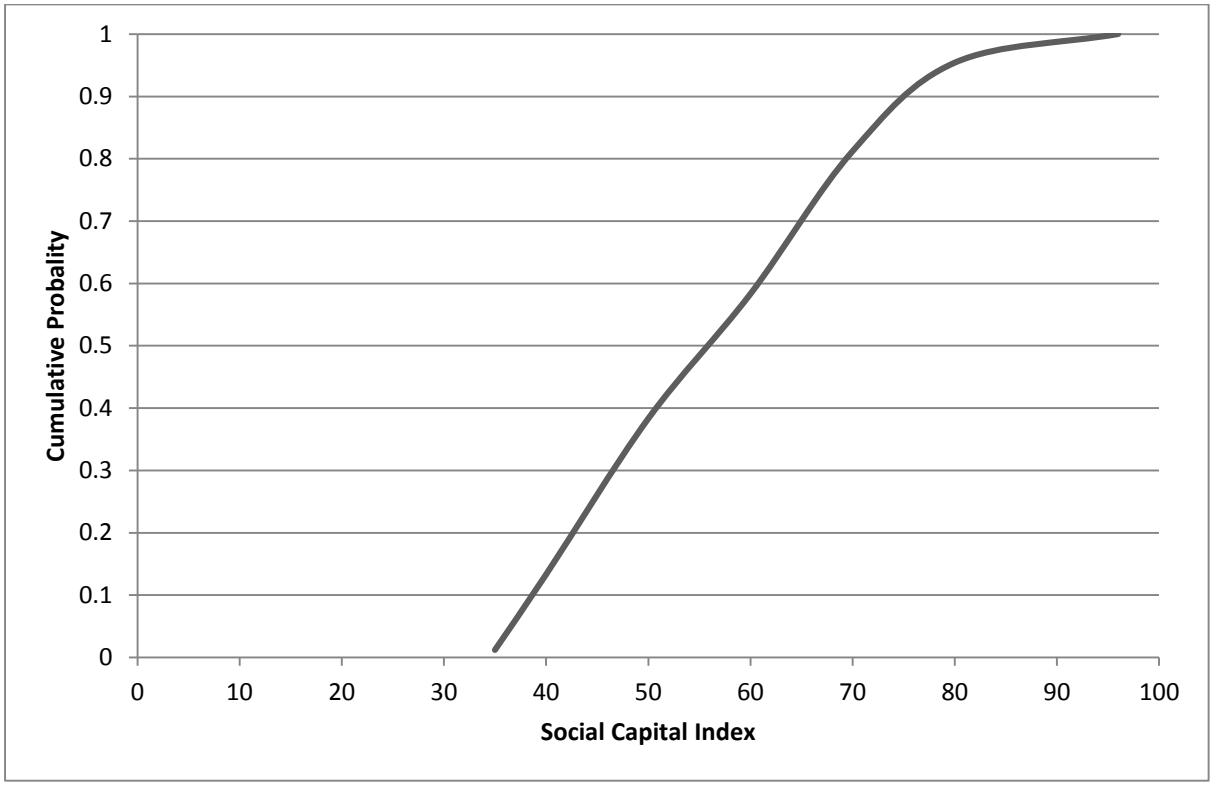

Figure 4.5: Cumulative probability distribution of the overall social capital indices of conventional pineapple farmers

The next section gives a description of the physical (farms and market structure) and institutional environment that also influence the behaviour and performance of conventional pineapple farmers.

4.1.3.1.2 Institutional Environment and Structure (Level 2 of VC-NIE-SCP)

The institutional environment and structure level of the integrated VC-NIE-SCP framework is concerned with the physical and institutional environment within which the conventional farmers operate. The structure component comprise the average size of conventional farms, distribution of land among conventional farmers, the land ownership and tenure of conventional farms, the different types of markets available to conventional farmers and actors in the markets, and the location of input and output markets. The institutional environment contains all the formal and informal rules and regulations that influence the way in which certified organic farmers behave within the value chain. The institutional environment

influences the structure, and similarly the structure is also influenced by rules and regulations that are specified in the institutional environment.

4.1.3.2 Value chain players

The conventional pineapple value chain players include all actors in the value chain who are involved in moving the pineapples produced by the farmers from the production area to the end consumers. Figure 4.6 below shows a schematic representation of the flow of conventional pineapple from input suppliers to end buyers. The actors in the conventional pineapple value chain are small- and large-scale input suppliers, farmers, exporters, processors, market women (wholesalers), retailers and consumers. There are three categories of producers in the conventional pineapple value chain. These are small-scale farmers, medium-scale commercial producers and large-scale commercial producers or exporters. The large-scale commercial producers/exporters include both local and international agribusiness corporations. The small-scale producers comprise farmers who cultivate from 0.5 acre to about 7acres of land, while the medium-scale farmers are farmers who cultivate from 7.1 acres to about 14 acres of and. The large-scale producers cultivate pineapple in lands above 14 acres.

Pineapple produced by small- and medium-scale farmers is distributed to processors and large-scale producers/exporters, although the majority of small-scale producers have no contract arrangements with large-scale producers or exporters. The large-scale producers or exporters purchase from smallholders (spot markets) to supplement their large production. Large/medium scale companies and international corporations operate at different stages of the value chain; some are producers, others are processors and exporters. Some large-scale producers of conventional pineapple often manage to integrate all these activities into their operations. The companies are either established by local entrepreneurs or operate through joint ventures with foreign investors or partners. Pineapple produced by large-scale companies is distributed to both the export and domestic markets. The pineapple producers grade their pineapples and send quality grades to the export market. The rejected grades (or pineapples that do not meet the export requirements) are either processed by the large-scale farmers or processors, or traded through a network of wholesalers and retailers, also known as middlemen.

The market women then make the fresh pineapple readily available on roadsides and in local open markets. Processing companies process fresh pineapple into fresh cuts, fruit salad, dried pineapple and juice products for the export markets and urban consumers at the local market.

Whole fresh and processed pineapples are distributed to wholesalers and large supermarkets in the export market. For the purpose of this study, the pineapple farmers in the conventional value chain are of major importance as value chain players. The next section focuses on analysing the behaviour of the value chain players.

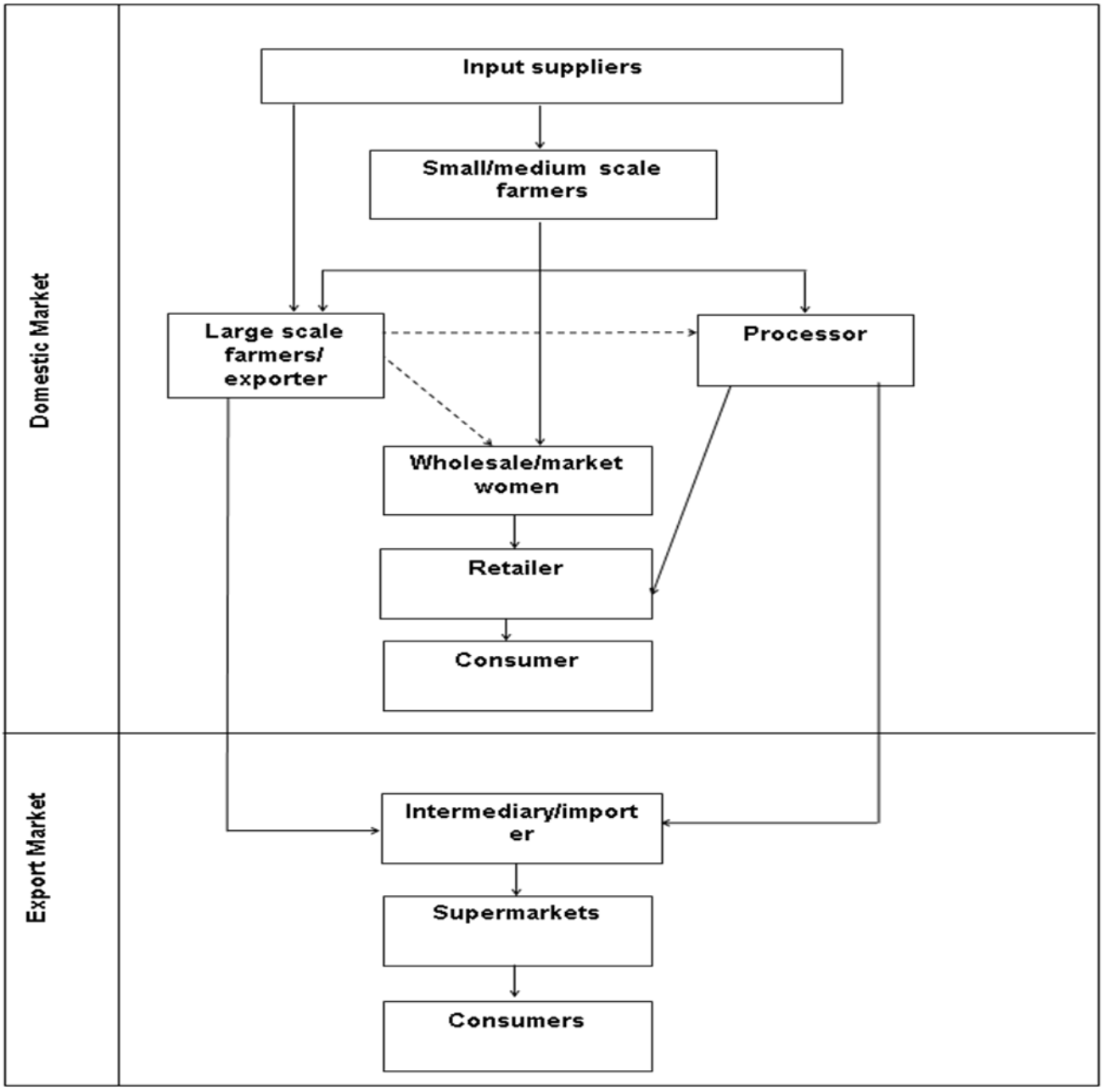

Figure 4.6: Schematic representation of the flow of conventional pineapple from input suppliers to end buyers

4.1.3.2.1 Governance structures and Conduct (Level 3 of VC-NIE-SCP)

This level of the VC-NIE-SCP framework assesses the governance structures and behaviour (conduct) of value chain players. This section describes the conduct of conventional value

chain players in order to better understand their behaviour, followed by a brief description of the governance structure that is used to manage the transactions between the conventional farmers and pineapple traders in the region. The behaviour of conventional farmers is concerned with the production practices used by farmers, the sources and availability of credit for funding production activities, the sources and availability of market information, and the method of price formation. Furthermore, the investment in technical training, the behaviour of the traders in the market, the level of competition in the market, the types of contracts that are employed, and the marketing strategies being used by certified organic farmers are aspects of conduct that are discussed in this section.

- **Governance structure**

Conventional pineapple farmers currently employ three types of governance structure when marketing their organic pineapple. The first type of arrangement is the spot market, where farmers can sell their pineapples to any wholesaler (middlemen), processing company, large-scale companies or exporters in the region. The second is hybrid form of governance where small-scale farmers have access to credit coordination with buyer (middlemen). In this form of governance, the middleman offers farmers credit support for production activities. The farmer is then committed to the middleman in selling their produce only to the wholesaler. The last type of governance is also a hybrid type of governance, where farmers enter into a contractual relationship with a pineapple processing or exporting company that operates in the region. Selling through a contract arrangement means that the farmer and the contract company or exporter create a binding oral or written contract, where a proportion of harvest may be committed to the company or processor for an agreed price, as and when the company needs pineapple to be supplied. The company or exporter is seen as the first buyer of the certified organic farmers output, before the rest of the pineapples can be spot marketed. Next is the discussion of the performance of conventional farmers, which concludes the description of the value chain players of conventional production system.

4.1.3.2.2 Resource allocation and Performance (Level 4 of VC-NIE-SCP)

Resource allocation and performance is the fourth level of the VC-NIE-SCP framework. At this level of resource allocation and performance, production and marketing performance of certified organic farmers is evaluated, with special reference to the actual quantity or volumes of conventional pineapple produced, sales, and quality of conventional pineapple produced. Table 4.3 below presents the statistics on the volume, prices, and sales of conventional pineapples produced during the 2012–2014 production season. The study captured total

pineapple harvested from 2012 to 2014 because the cultivation of pineapple from land preparation to harvesting of slips takes two years.

Table 4.3 below shows that the average quantity of conventional pineapple produced during the 2012–2014 production season was 20 340.46 kilograms per acre. The minimum quantity of pineapples obtained by non-certified organic farmers was 5 796.00 kilograms per acre, while the maximum obtainable pineapple yield was 44 776.12 kilograms per acre. The average volume of conventional pineapple harvested on a one-acre plot by conventional pineapple farmers is higher than that of the pineapple harvested on a similar sized plot on a certified organic pineapple farm. However, Yankson (2015) has argued that the quality of the conventional pineapple in the region is low because it has high water content. The water content is a result of the overuse of fertiliser by the farmers.

The price received by non-certified organic farmers for a 1 kg pineapple ranges from GH¢ 0.40 to GH¢ 1.25. The average price for conventional pineapple is 0.63, which is lower than the average price obtained by certified and non-certified organic farmers. This resulted in low total sales obtained by conventional farmers for the 2012–2014 production season. It is seen in Table 4.3 below that the total sales per acre obtained by conventional pineapple farmers range from GH¢ 3 000.00 to GH¢ 22 388.06, with the average being GH¢ 10 419.66 per acre.

Table 4.3: Summary statistics of output and sale of conventional pineapple for the 2012/2014 production season

Variable	Unit	Mean	Minimum	Maximum
Quantity	kg/acre	20 340.46	5 796.00	44 776.12
Price	GH¢/kg	0.63	0.40	1.25
Total sales	GH¢/acre	10 419.66	3 000.00	22 388.06

The next section presents results on the relationship between factors within the social, physical and institutional environments and farmers' choice of certified organic production compared with conventional and non-certified organic production.

4.2 Factors Influencing Farmers' Choice of Pineapple Production System in Ghana

Farmers' choice of a particular pineapple production system is influenced by a variety of social, physical and institutional factors which need to be determined and addressed. Therefore, the study adopted a multinomial logit model to determine the factors that influence farmers' choice of identified pineapple production systems in the Central Region of Ghana. The results are presented in Table 4.4 below. The multinomial logit was estimated for three categories of production system, namely the certified organic production system, the non-certified organic production system, and the conventional production. However, the conventional production system was used as the reference category since it is the commonly practised pineapple production system in the study area. Table 4.4 shows the multinomial logit estimates, which consist of coefficient estimates, robust standard errors, z-statistics and marginal effects. It must be emphasised that the constant term was suppressed during the estimation process for improvement in the results. The estimates for the certified organic production show that out of the 39 variables considered in the study, 27 were significant in influencing the probability of farmers choosing the certified organic production system.

Among the personal factors, senior high school (SSS_Educ), training college (Training_Educ) and undergraduate university levels of education (Undergrad_Educ) have negative influences and reduce the probability of farmers choosing certified organic pineapple production over conventional pineapple production. Household size, off-farm activity and wealth of farmers were significantly negative, and hence reduce farmers' probability of choosing a certified organic production method. For policy implications, the marginal effects will be interpreted. The marginal effects show that a change in a farmer's education from basic to senior high school education results in 0.812 reductions in the probability of the farmer adopting certified organic pineapple production at 5 % level of significance, compared with conventional production methods. On the other hand, farmers who have attained training college education were 0.096 less likely to adopt certified organic pineapple production, relative to conventional production at 1 % level of significance, as compared with farmers with basic education. This in line with the findings of Hollaway *et al*. (2002) who found that education negatively influences farmers' decisions to adopt certified organic production. This is probably attributable to the fact that senior high school, training college and undergraduate university levels of education provide more profitable off-farm employment opportunities in Ghana.

A unit increase in the proportion of household members who are able to work on the farm reduces the probability of the farmer adopting certified organic pineapple production by 0.148, at 1 % significance level, compared with conventional production. This is contrary to the a priori expectation and the findings of Kisaka-Lwayo (2007) and Burton *et al.* (1999). This may be attributable to the fact that not all the members of a household who can work on the farm do actually work on a certified organic farm; some participate in other farm and off-farm activities. Farmers who engage in off-farm activities are 0.040 less likely to adopt certified organic pineapple production, relative to conventional production, at 1 % significance level, compared to farmers who do not engage in off-farm activities. This is supported by the findings of Beus & Dunlap (1994) and Fairweather (1999) because a farmer who has off-farm activities and relies on off-farm income sources to subsidise farm operations and capital investment tends to positively relate more to conventional production behaviour.

An increase in the wealth of farmers (Wea) results in 0.436 reduction in the farmers' probability of adopting certified organic production at 5 % significance level, all things being equal. This is contrary with the a priori expectation and findings of Kleemann (2012) who identified the wealth of a farmer to positively influence the farmer's choice of certified organic production. The reason might be that wealthier farmers have the purchasing power to buy chemicals and other inputs required for conventional production methods.

Regarding the attitudinal and behavioural factors, the results show that the dummy variables for farmers who have high environmental concern (High_Envcon) and those who are just concerned (Con_Envcon) about the environment have positive influences on farmers' choice of certified organic production. The marginal effects show that farmers who are highly concerned about the environment are 0.814 more likely to adopt certified organic production, at 5 % significance level, compared with farmers who are not concerned about the environment relative to conventional production. Likewise, farmers who are just concerned about the environment are 0.186 more likely to adopt certified organic production, at 5 % significance level, compared with farmers who are not concerned about the environment. This is in line with the a priori expectation and is supported by the findings of Läpple (2010) and Best (2010).

Perceived compatibility of previous production to certified organic production (ComPerc) has a negative influence on farmers' choice of a certified organic pineapple production method. This is contrary to the a priori expectation. The marginal effects shows that farmers who agreed that their previous production was easily compatible with certified organic production were 0.315 less likely to adopt certified organic production, compared with farmers who

disagreed that their previous production was easily compatible. This suggests that, compatibility of production system to certify organic pineapple production system does not necessarily means a farmer will adopt certified organic production but rather the decision depends on other factors. Perception of premiums for organic product (PrePerc) has a positive influence on farmers' choice of certified organic pineapple production. The marginal effect shows that farmers who agree that organic products attracts high premiums are 0.058 more likely to adopt certified organic production, at 5 % significance level, compared with farmers who disagree that organic pineapple attracts high premiums. This is in line with a priori expectations and is supported by the findings of Fairweather (1999) and Serra *et al*. (2008) who found farmers' perception about organic price premiums to be a powerful instrument in motivating the adoption of certified organic production.

Proportion of hired labour to total labour used on a pineapple farm per farming season (Labtyp) has a positive influence on farmers' choice of certified organic pineapple production. This implies that the higher the proportion of hired labour is, the higher the probability of the farmer adopting certified organic pineapple production will be. This is contrary to the a priori expectation and the findings of Carolyn (1999). The difference might be attributable to the knowledge of hired labourers. For instance, it might be that the hired labourers have more knowledge in organic production and as such will positively influence the adoption of certified organic production. The factor of contracts with certified organic pineapple exporters or processors (Cont) has a significantly positive influence on farmers' choice of a certified organic pineapple production system, at 1 % level of significance. The marginal effect indicates that farmers who have a contract with certified organic pineapple companies are 0.473 more likely to adopt certified organic production to meet the requirements of export buying companies or local processing companies based on their specifications, compared with farmers who do not have contracts. This is in line with the a priori expectation and the findings of Radwan *et al*. (2011).

Training on organic production (Train) has a positive influence on farmers' choice of certified organic pineapple production. The marginal effect shows that an increase in the number of training sessions a farmer receives on organic production results in 0.052 increase in the farmers' chances of adopting certified organic production. This is in line with the expected sign and is supported by the findings of Saha *et al.* (1994) and Lindner (1987). Training on organic production system improves farmers' ability to acquire accurate information and understand organic production practices very well. Access to government-subsidised inputs (Chinp) has a negative influence on farmers' choice of certified organic pineapple production. The marginal effect shows that access to subsidised chemical inputs reduces farmers' chances of adopting

certified organic pineapple production by 0.425, at 10 % significance level. This is in line with a priori expectation and is supported by the findings of Constance & Choi (2010) and Ghorbani *et al*. (2011).

The supply of subsidised inputs, such as chemical fertilisers and agrochemicals, to farmers favours conventional production systems because the inputs supplied are mainly used for conventional production systems and once farmers receive the inputs, they may be forced to adopt conventional farming. Access to support services from government or NGOs (Orgsup) has a positive influence on farmers' choice of certified organic pineapple production. The marginal effect estimate shows that farmers who have access to support services from government and NGOs are 0.237 more likely to adopt certified organic pineapple production methods, at 1 % significance level, compared with farmers who do not have access to support from government and NGOs. This confirms the a priori expectation and is supported by the results of Kleemann (2012) and Adebiyi (2014). The support services serve as an incentive for adopting a certified organic production system.

Social capital index has a positive influence on farmers' choice of certified organic pineapple production methods, compared with conventional production methods. This is consistent with the a priori sign and the findings of Thapa & Rattanasuteerakul (2011) and Milagrosa (2007b). The marginal effect shows that an increase in the social capital index results in 0.050 increase in the farmers' choice of certified organic pineapple production, compared with conventional production, since farmers' participation in civic organisation results in high levels of association among farmers, which in turn encourages their collective behaviour and improves the effectiveness of collective actions.

Within the physical environment, farm size has a negative influence and reduces farmers' probability of choosing certified organic pineapple production by 0.148, at 1 % level of significance, compared with conventional production methods. This is consistent with the expected sign. Thus, as farm size increases, the probability of farmers' choosing a certified organic production method decreases. Distance from farm to organic market (Fdist) has a negative influence on farmers' choice of certified organic pineapple production, compared with conventional production. The estimates show that an increase in the distance from farm to market by 1 km reduces farmers' chances of adopting certified organic pineapple production by 0.020, at 1 % significance level. This is in line with the expected signs and is supported by the findings of Padel (2001). The longer the distance from the farm to the certified organic market is, the higher the transaction cost and the higher the chances of farmers growing conventionally and selling their produce at the nearby market will be. The marginal effect for

access to an available certified organic market (Mavail) has a positive influence on farmers' choice of a certified organic pineapple production method. Farmers who have access to an available certified organic market are 0.703 more likely to adopt certified organic pineapple production, at 1 % significance level. This is consistent with the expected sign and is supported by the results of Burton *et al.* (1999). The availability of an organic market triggers the entry of large-, medium- and small-size farmers and encourages organic farmers to produce more certified organic products, all things being equal.

Concerning institutional environment, factors such as owned land tenure system (Own_Lten) have a negative influence on farmers' choice of certified organic pineapple production, compared to a conventional production method. The marginal effect estimate shows that farmers who farm on their own land are 0.140 less likely to adopt certified organic pineapple production, compared with farmers who farm on rented land, whereas farmers who farm on family lands (Family_Lten) are 0.159 more likely to adopt certified organic pineapple production, compared with farmers who farm on rented lands. This is contrary to the findings of Fertô & Forgács (2002) and Kallas *et al*. (2009) who found that family land tends to have a negative influence on the adoption of certified organic production. The differences might be due to differences in location and land tenure arrangements in the study areas.

The dummy variable for low level of knowledge on land tenure systems (LTSR_low_knowl) has a positive influence on farmers' choice of certified organic pineapple production, compared to conventional production methods. The marginal effect shows that farmers who have low knowledge of land tenure systems are 0.454 more likely to adopt certified organic pineapple production, compared with farmers who do not have any knowledge of the land tenure systems prevailing in the study area. On the other hand, for farmers who have medium and high knowledge of the land tenure systems, these have significantly negative influences and reduce the probability of farmers choosing certified pineapple production, compared with farmers who do not have knowledge of land tenure systems. This means that the land tenure system prevailing in the study area does not favour certified pineapple production, in the sense that farmers who are more knowledgeable about the land tenure system opt for producing pineapple conventionally. For instance, being highly knowledgeable about the land tenure systems reduces farmers' chances of adopting certified organic production by 0.666, at 10 % significance level.

Level of knowledge on organic standards and regulations did not have any significant influence on farmers' choice of certified pineapple production, compared with the conventional production method. However, low knowledge of phytosanitary regulations (Phyto_low_knowl)

has a significantly negative influence on farmers' choice of certified organic pineapple production, compared with conventional production methods. Having low phytosanitary knowledge is associated with 0.874 reduction in farmers' chances of adopting certified organic pineapple production, at 1 % significance level, compared with farmers who have no phytosanitary knowledge. Medium knowledge of phytosanitary regulations has a positive influence on farmers' choice of certified pineapple production, compared with the conventional production method. Having medium knowledge of phytosanitary regulations (Phyto_medium_knowl) increases farmers' probability of adopting certified organic pineapple production by 0.425, at 1 % significance level, compared with farmers who have no knowledge of phytosanitary regulations. This implies that knowledge of phytosanitary regulations plays a significant role in influencing farmers' choice of certified organic pineapple production.

Lastly, low level of traditional knowledge (Trad_low_knowl) has a positive influence and increases farmers' chances of adopting certified organic pineapple production by 0.157, at 5 % significance level, compared with farmers who have no knowledge of the traditional norms, taboos and culture in the study area. This suggests that farmer's level of knowledge about the traditions in the farming communities influences his or her choice of production system.

Table 4.4 also shows the multinomial logit estimates for the non-certified organic pineapple production. The coefficient estimates for the non-certified organic pineapple production show that 14 out of the 39 variables included in the model were significant. Senior secondary school education (SSS_Educ) has a negative influence on farmers' choice of non-certified organic pineapple production, compared with conventional production methods. The marginal effect shows that a change in a farmer's educational level from basic education to senior high school reduces the farmer's probability of adopting non-certified organic pineapple production by 0.905, at 1 % significant level, whereas changes in a farmer's educational level from basic to training college, and undergraduate university education, have negative influences and reduce the probability of the farmers' choosing non-certified organic production system by 0.826 and 0.790, respectively, at 1 % significance level, compared with conventional production methods. This implies that as a farmer's level of education increases, the probability that the farmer will adopt non-certified organic pineapple production reduces. The reason may be that, as farmers' educational levels increase, they engage in off-farm employment which increases their income, and also that such farmers are able to purchase chemical inputs which are required for conventional production methods. This is supported by the findings of Hollaway *et al*. (2002).

The factor of having contracts with certified organic pineapple exporters or processors (Cont) has a significantly positive influence on farmers' choice of non-certified organic pineapple production systems, at 1 % level. The marginal effect indicates that a change in farmers' status from no contract to having a contract with certified organic pineapple exporters or processors leads to 0.956 increase in the farmers' chances of adopting non-certified organic production.

Table 4.4: Multinomial logit estimate for factors influencing farmers' choice of pineapple production systems in Ghana

Certified Organic	Coefficient	Robust Std Errors	Z statistics	Marginal Effects(dy/dx)	Z statistics
Noformal_Educ	-3.072	1.981	-1.55	-0.485	-1.63
SSS_Educ	-12.217*	6.366	-1.92	-0.812**	2.40
Training_Educ	-18.211***	4.323	-4.21	-0.096***	4.69
Undergrad_Educ	-17.698**	7.115	-2.49	0.986	1.59
Fexp	0.096	0.098	0.99	0.007	0.33
HHsize	-1.621***	0.301	-5.39	-0.148***	-6.67
Finc	-0.091	0.057	-1.61	-0.040***	-5.52
Off_f	-2.751**	1.194	-2.30	-0.531*	-1.93
Cont	50.098***	5.391	9.29	0.473***	9.95
Extco	0.186	0.357	0.52	0.058	0.03
Train	0.726***	0.132	5.50	0.052***	5.74
Infoav	2.096	2.568	0.82	0.056	0.71
Cred	0.771	1.013	0.76	-0.224	-0.40
Chinp	-4.528**	2.155	-2.10	-0.425*	-1.68
Orgsup	32.851***	2.258	14.55	0.237***	12.79
Mavail	12.519***	2.377	5.27	0.703***	5.55
Fdist	-1.237***	0.054	-22.74	-0.020***	-20.87
High_Envcon	5.564***	1.919	2.90	0.814**	2.12
Con_Envcon	8.595***	2.971	2.89	0.186**	2.02
Wea	-1.277*	0.694	-1.84	-0.436**	2.23
ComPerc	-7.856*	4.117	-1.91	-0.315***	-3.36
PrePerc	5.755**	2.864	2.01	0.058**	2.42
CertPerc	0.506	1.532	0.33	0.523	-0.11
ProfPerc	0.216	1.663	0.13	-0.589	-0.30
Labtyp	0.133***	0.049	2.70	-0.002	-2.75
Fsize	-0.908***	0.225	-4.04	-0.148***	-5.20
Own_Lten	-6.390***	2.181	-2.93	0.140***	3.37
Family_Lten	5.079***	1.322	3.84	0.159***	3.47
LTSR_low_knowl	8.298***	2.661	3.12	0.454*	1.97
LTSR_medium_knowl	-4.515*	2.650	-1.70	-0.399	-1.54
LTSR_high_knowl	-7.251**	3.370	-2.15	-0.666*	-1.69
OSR_high_knowl	2.901	5.591	0.52	0.143	0.34
OSR_low_knowl	2.882	4.437	0.65	0.967	0.93
OSR_medium_knowl	-2.586	5.237	-0.49	-0.251	-0.35
Phyto_medium_knowl	7.484***	1.442	5.19	0.425***	5.35
Phyto_low_knowl	-7.315***	2.510	-2.91	-0.874***	-4.44
Trad_high_knowl	0.757	1.559	0.49	0.881	-0.80
Trad_low_knowl	6.603***	2.203	3.00	0.157**	2.29
Scap	0.161*	0.096	-1.67	0.050**	2.31

Table 4.4 Multinomial logit estimate for factors influencing farmers' choice of pineapple production systems in Ghana (Continued)

Non-certified organic	Coefficient estimates	Robust Std Error	Z statistics	Marginal Effects(dy/dx)	Z statistics
Noformal_Educ	2.557	1.826	1.40	0.298	1.46
SSS_Educ	-13.555**	6.370	-2.13	-0.905***	-5.68
Training_Educ	-21.894***	2.650	-8.26	-0.826***	-3.96
Undergrad_Educ	-12.822*	6.811	-1.88	-0.790***	-3.36
Fexp	-0.098	0.093	-1.06	-0.018	-0.78
HHsize	-0.265	0.273	-0.97	-0.050	-1.25
Finc	0.061	0.055	1.11	0.012**	1.93
Off_f	-0.365	1.041	-0.35	-0.067	-0.40
Cont	12.091**	5.039	2.40	0.956***	23.13
Extco	0.763**	0.319	2.40	0.142	1.28
Train	0.120	0.116	1.03	0.022	0.68
Infoav	-0.151	2.363	-0.06	-0.028	-0.06
Cred	0.415	0.839	0.49	0.075	0.42
Chinp	-7.568***	1.968	-3.85	-0.927***	10.21
Orgsup	6.057***	1.906	3.18	0.894***	9.77
Mavail	-0.583	1.256	-0.46	-0.108	-0.54
Fdist	-0.134***	0.051	-2.65	-0.025*	-1.69
High_Envcon	0.274	1.699	0.16	0.049	0.17
Con_Envcon	8.283***	2.899	2.86	0.964***	17.31
Wea	-0.548	0.664	-0.83	-0.102	-1.34
ComPerc	-3.000	4.049	-0.74	-0.514	-1.43
PrePerc	6.254**	2.827	2.21	0.916***	8.00
CertPerc	2.470*	1.367	1.81	0.456*	1.84
ProfPerc	-0.804	1.554	-0.52	-0.142	-0.42
Labtyp	0.022	0.036	0.61	0.004	0.56
Fsize	-0.346	0.216	-1.60	-0.065**	-2.21
Own_Lten	-3.060	2.105	-1.45	-0.643**	-2.05
Family_Lten	-1.247	1.035	-1.20	-0.276	-1.30
LTSR_low_knowl	0.650	2.334	0.28	0.105	0.33
LTSR_medium_knowl	-5.636**	2.486	-2.27	-0.865***	-4.23
LTSR_high_knowl	-3.573	3.228	-1.11	-0.707	-1.51
OSR_high_knowl	2.656	5.515	0.48	0.306	0.55
OSR_low_knowl	5.739	4.177	1.37	0.383	0.93
OSR_medium_knowl	1.813	5.142	0.35	0.300	0.33
Phyto_medium_knowl	0.344	1.245	0.28	0.061	0.29
Phyto_low_knowl	-1.630	2.345	-0.69	-0.371	-0.60
Trad_high_knowl	1.005	1.410	0.71	0.177	0.99
Trad_low_knowl	3.225**	1.832	1.76	0.273	1.00
Scap	-0.041	0.093	-0.44	-0.008	-0.35
Base category	= Conventional production				
Log pseudo likelihood	= -25.312				
Number of obs	= 295				
Wald chi2(78)	= 18066.38				
Prob > chi2	= 0.0000				

***, ** and * represents statistical significance at 1 %, 5 % and 10 % respectively

This is in line with the a priori expectation and the findings of Radwan *et al*. (2011). The number of extension contacts per production season (Extco) has a significantly negative influence on farmers' choice of non-certified pineapple production. The marginal effects further show that even an increase in the number of extension contacts per season will not have a significant influence on farmers' choice of non-certified organic production, compared with conventional production methods. This may be attributable to the fact that most of the extension contact sessions are geared towards changing farmers' attitude from the traditional non-certified production methods to certified production methods.

Access to government-subsidised inputs (Chinp) has a negative influence on farmers' choice of non-certified organic pineapple production. The marginal effect shows that having access to subsidise chemical inputs reduces farmers' chances of adopting non-certified organic pineapple production by 0.927, at 1 % significance level. This is in line with the expected sign and is supported by the findings of Constance & Choi (2010). The supply of subsidised inputs in Ghana is geared towards conventional production systems because the inputs supplied are mainly for conventional production systems, and once farmers receive the inputs they may be forced to adopt conventional farming.

Access to support services from government or NGOs (Orgsup) has a positive influence on farmers' choice of non-certified organic pineapple production. The marginal effect estimate shows that farmers who have access to support services from government and NGOs are 0.894 more likely to adopt non-certified organic pineapple production methods, at 1 % significance level, compared with farmers who do not have access to support services from government and NGOs.

The factor of farmers who are concerned (Con_Envcon) about the environment has positive influence on farmers choice of non-certified organic production. The marginal effects show that farmers who are concerned about the environment are 0.964 more likely to adopt non-certified organic production, at 1 % significance level, compared with farmers who are not concerned about the environment. Perception of premiums for organic product (PrePerc) has a positive influence on farmers' choice of certified organic pineapple production. The marginal effect shows that farmers who agreed that organic products attract high premiums are 0.916 more likely to adopt non-certified organic production, at 1 % significance level, compared with farmers who disagreed that organic pineapple attracts high premiums. This is in line with the a priori expectations.

Perceived high cost of certification (CertPerc) has a positive influence on farmers' choice of non-certified organic pineapple production, at 10 % level of significance. This implies that non-certified organic farmers who agreed to the statement that certification cost is high are still more willing to adopt non-certified organic pineapple production. This is attributable to the fact that non-certified pineapple farmers do not pay for certification, and as such, they do not care much about whether it is high or not. The marginal effects show that farm size (Fsize) and owned land (Own_Lten) have negative influence on farmers' choice of non-certified pineapple production methods, compared with conventional production methods. The estimates show that an increase in farm size reduces farmers' chances of adopting non-certified organic pineapple production by 0.065, at 5 % significance level.

A change from renting farmland to ownership of land reduces farmers' probability of adopting non-certified organic pineapple production by 0.643, at 5 % significance level. This may be as a result of the fact that farmers who own lands have other profitable production activities that they use their owned land for, and also due to the land tenure arrangements in the region. The dummy variable for medium level of knowledge of land tenure systems (LTSR_medium_knowl) has a negative influence on farmers' choice of certified organic pineapple production, compared with conventional production methods. The marginal effect shows that farmers who have medium knowledge of the land tenure systems are 0.865 less likely to adopt non-certified organic pineapple production, compared with farmers who do not have any knowledge of the land tenure systems prevailing in the study area. Low level of traditional knowledge (Trad_low_knowl) has a positive influence and increases farmers' chances of adopting non-certified organic pineapple production, at 5 % significance level, compared with farmers who have no knowledge of the traditional norms, taboos and culture in the study area. The model has a Wald chi-square estimate of 18066.38, which is highly significant at 1 % significance level, which indicates that the variables jointly and significantly explain the farmers' choice of pineapple production system, all things being equal.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

5.1.1 Background and Motivation

The food and agricultural sector contributes immensely to Gross Domestic Product (GDP) and improvement in the livelihoods of most Ghanaians (Asante & Ntow, 2009; Owusu-Boateng & Amuzu, 2013). These contributions have led to the agriculture sector playing a central role in the developmental strategy of Ghana. Agricultural policies since 2002 have focused on improvement in market access, financial services, institutional capacity and unsustainable management of land in order to sustain growth and reduce poverty (MoFA, 2002). Certified organic pineapple production is one of the strategies that have received much attention as a rural development tool for improving small-scale farmers' livelihood in the Central Region of Ghana. This is because certified organic pineapple has high demand in the export and domestic markets (Kleemann, 2012; Adebiyi, 2014). Secondly, the promotion of certified organic pineapple production will also enable farmers to integrate into the competitive niche market (Adebiyi, 2014).

To increase the adoption of certified organic production and integrate the farmers into competitive markets, individual farmers must be willing to convert to certified organic production. Statistics indicate that a small fraction (0.2 %) of agricultural land is under certified organic production, despite the efforts from stakeholders to encourage, and disseminate information on the use of, certified organic production. The proportion of agricultural land under certified organic production is not the only concerning issue; the growth rate of land under organic production is slow. This implies that farmers are converting to or adopting the certified organic pineapple production at a slow rate. As a result, the potential of certified organic production as a rural developmental tool to improve farmers' livelihood in Ghana is yet to be optimised. Kleemann (2012) argues that the environmental situation of the community or region where certified organic production is being promoted may be a factor affecting the development of the organic sector in Ghana. However, uncertainty exists regarding the

important factors that explain why farmers do, or do not, choose certified organic production systems.

5.1.2 The Problem Statement and Objectives

Although the characteristics of the environment that the farmers are embedded in are recognised to influence farmers' behaviour, there is lack of understanding of the social, physical and institutional environment which the pineapple farmers operate in. As a result, stakeholders promote and make recommendations to increase the adoption of certified organic pineapple production, without considering the existing incentive structure that has caused the current choice behaviour of farmers. Furthermore, the extent to which factors within the social, physical and institutional environment contribute to the slow adoption of certified organic pineapple production system remains uncertain.

Various researchers in developed countries, and a few in developing countries, have endeavoured to conduct research on the importance of different factors influencing farmers' decisions to adopt certified organic production (Dabbert *et al*., 2004; Flaten *et al*., 2006; Kleemann, 2012). These numerous research studies have focused more on developed countries, with little consideration being given to sub-Saharan Africa, and Ghana in particular. The factors that have been identified by these researchers only apply to situations in the developed countries because conditions favouring conversion to certified organic production in those countries are very different from those in developing countries. The few studies done in developing countries did not consider the influence of factors impacting on the farmers' decision pertaining to the small-scale farmers' social and institutional environment in developing countries. The few studies carried out on certified organic production systems in Ghana (e.g. Danso *et al.,* 2002; Kleemann, 2011; Apinga, 2011; Kleemann & Abdulai, 2012) did not focus on identifying the factors that influence pineapple farmers' choice of production systems in Ghana. None of these studies in Ghana have considered the effects of factors on behaviour choice within the social, physical and institutional environment that the small-scale pineapple farmers operate under. Thus, the influence of these factors on pineapple producers' choice of production systems is unknown.

The main objective is to examine farmers' decision and choice of production systems for pineapple production in order to determine the effect of factors within the social, physical and institutional environment that the farmers operate in. The main objective was addressed through the completion of two sub objectives. Firstly, the identification and description of the characteristics and requirements of the different pineapple production systems were analysed

using the VC-NIE-SCP framework. The VC-NIE-SCP framework was used in order to obtain a better understanding of pineapple production and marketing with respect to the social, physical and institutional environment. Secondly, the factors that might influence farmers' decision and choice of pineapple production system in Ghana were determined in order to assess the relationship between social, physical and institutional factors and farmers' behaviour choice.

5.2 Literature Review

5.2.1 Pineapple Sector in Ghana

Pineapple is a strategic crop that is being promoted by the government of Ghana as a rural developmental tool for improving small-scale farmers' livelihoods. The Ghanaian pineapple sector became one of the top suppliers of pineapple to the European Union market, along with Côte d'Ivoire and Costa Rica in 2005 (Achaw, 2010). Unfortunately, the industry encountered a challenge that led to the reduction of the country's market share in the export market after 2005. Despite the challenges which undermined the industry's competitiveness, pineapple is still the single most important and lucrative non-traditional export crop in Ghana. The crop is also a source of employment and income to about 2 % of rural households in Ghana (GSS, 2008). This renders the crop a good choice for the study because the crop have been strategic, given its potential to contribute towards national export drive, foreign exchange earnings and poverty alleviation, especially for smallholder producers. Furthermore, the industry is focused on enforcing of good agricultural practices, production, and a certification system that also protects the environment from unsustainable practices.

5.2.2 Production Systems

Various farm management approaches for farming have been developed and adopted by farmers, over time. However, in Ghana, conventional production is the dominating system used by farmers and has become the mainstream form of agriculture (Pattanapant & Shivakoti, 2009). A conventional production system involves the use of synthetic farm inputs, such as fertilisers, pesticides, hormones and antibiotics (Connor, 2008; Gianessi, 2009). Other forms of production systems that have emerged after the conventional production system are termed alternative production systems. For instance, organic production (farming) is one of the alternative production systems that have emerged.

Organic production is defined as a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity (FAO/WHO Codex Alimentarius Commission, 1999). The organic production system can be categorised into two, namely non-certified organic production systems and certified organic production systems. The study focuses on the certified organic production system owing to the fact that it is the main system that is being promoted in Ghana. Also, it has economic benefits, such as cost impact, market access, price premiums and improved net returns (Cranfield *et al.,* 2010; Kleemann, *et al.,* 2014).

5.2.3 Literature on Factors Influencing Farmers' Choice of Certified Organic Production

The factors identified in literature to influence the choice of certified organic production systems include personal factors, attitudinal factors, behavioural factors, social factors and institutional factors (Caswell, 2001; Kallas *et al*., 2009; Läpple, 2010). The personal factors include education, farming experience, household size, off-farm economic activity, farm income and wealth of the farmer, being influences on the farmers' choice of a certified organic production system.

Attitudinal and behavioural factors identified in literature to influence farmers' choice of certified organic production system from among other production systems include farmers' perceptions about price premiums, perceived profitability of certified organic production, perceived compatibility of the previous production system with the certified organic production system, farmers' perception about the absence of national organic regulation, certification cost and farmers' environmental attitude. Other factors, such as the type of labour use on the farm, contracts with certified organic pineapple exporters or processors, organic extension contacts, training on organic farming, availability of information on certified organic production and marketing, access to credit, access to subsidised chemical inputs and access to organisational support, also influence farmers' choice of certified organic production systems.

Factors related to the social environment, such as social capital level of the farmers, were found in the literature review to influence farmers' choice of certified organic production from among other production systems. Social capital is a feature of social organisation (for example trust, norms, volunteerism, reciprocity, networks, association, traditions and beliefs) that can improve societal efficiency by facilitating coordinated action (Putnam, 1993, as cited by Jordan, 2012).

Physical factors, such as farm size, certified organic market availability and access, and distance from farm to organic market, were found in the literature review to influence farmers' choice of certified organic production from among other production systems (Rigby & Young, 2000). Institutional factors found to influence farmers' choice of certified organic production included the form of land tenure and security systems available in the farming community (Kallas *et al*., 2010). Hence, all the factors were hypothesised to influence pineapple farmers' choice of a certified organic production system.

5.2.4 Methods for Estimating Factors Influencing Farmers' Choice of Production System

Several analytical methods have been employed in analysing the factors influencing the choice of a certified organic pineapple production system. The analytical methods that have been employed to analyse the factors can be categorised into two, namely non-parametric approaches and the parametric or econometric approaches (Kisaka-Lwayo, 2012). The non-parametric approaches that have been used are ethnographic decision tree modelling (Fairweather 1999), descriptive statistics (Cranfield *et al.,* 2010) and qualitative narrative (Duram, 1999; Brock, 2010). The econometric approaches found include probit, logit and Tobit models, the multinomial logit model, linear discriminant function and duration analysis (Gardebroek & Jongeneel, 2004; Isgin *et al.,* 2008; Kallas *et al.,* 2009). The multinomial logit model was chosen for this study for analysing the factors that influence farmers' choice of pineapple production systems in Ghana. This is because the farmers or respondents have three production systems to choose from and these production systems are not arranged in any order, nor do they have any intrinsic order.

5.3 Data and Methodology

5.3.1 Study Area

Central Region is found at the southern part of Ghana where the average annual rainfall experienced in the ranges from 1 000 mm along the coast to about 2000 mm in the interior. The mean monthly temperature experienced in the region ranges from about 24^0C to about 30^0C. The total land area occupied by the region is about 9 830 km2 (983 000 ha). About 7 864 km2 (786 400 ha) is classified as agricultural land. Out of the total agricultural land, 393 200 ha are under cultivation.

The Central Region is one of the major pineapple production areas in Ghana. Out of the 20 districts in the region, pineapple is produced in eight districts. Three out of the eight districts produce pineapple for the export market, whereas the remaining five districts produce pineapple for the domestic market. The total area under pineapple production is not known. The average farm size is 0.5 hectares (1.235 acres). Most of the farmlands in the region are family or clan lands and the distribution of the lands is in the hands of family heads.

Input supply stores are located in most districts, as well as in farming villages in the region. Few farmers need to travel outside farming communities in order to purchase farm inputs. Good farm-to-market roads are necessary for transporting farm produce. The road network in the region ranges from asphalted main roads to unpaved village-level roads. The roads from the farms to the villages are mostly unpaved, whereas the roads from the villages to the markets are mostly asphalted roads.

5.3.2 Data Collection

The primary data was collected using focus group discussions, key informant interviews and a structured questionnaire. The multistage sampling approach was employed. The first stage involves the purposive selection of the Central Region of Ghana. The pineapple producing districts in the region were stratified into two, based on target markets, into export and domestic markets. Two districts were randomly sampled from each stratum. Awutu-Senya West and Gomoa East Districts were randomly selected from the districts producing for domestic markets, whereas Komenda Edina Eguafo Abirem (KEEA) and Gomoa West Districts were randomly selected from the districts producing for export markets. From each of the selected districts, 50 farmers were selected from a list of pineapple farmers obtained from the districts' agricultural offices and farmer-based organisations. Additionally, Ekumfi District was purposively sampled because the preliminary study revealed that the district has large numbers of small-scale organic farmers. From the Ekumfi District, 100 farmers were selected using simple random sampling. It must be emphasised that the difference in the number of farmers from the districts is based on proportion sampling (Kothari, 2004). In all, a total of 5 districts and 300 farmers were sampled for the study.

Five agricultural directors and five extension officers responsible for pineapple production in the sampled districts were selected for key informant interviews. Thirty experienced farmers, 10 from each production system, were purposively selected for the focus group discussions on the production systems. Three focus group discussions were conducted for the study. Face-to-face interviews were conducted with the directors and departmental heads of the

following institutions, namely GEPA in charge of pineapple exports, certification bodies, the GSB, and the horticultural, plant protection and regulatory services (PPRSD) departments of MoFA to obtain detailed information and documents on the characteristics and requirements that the farmers need to meet in order to produce and market under each of the production systems.

5.3.3 Characteristics of the Respondents

The survey data shows that among the 295 farmers interviewed, the majority (140) were practising conventional pineapple production, while 79 were certified organic producers, with 76 being non-certified organic farmers. Males constituted the majority in all the three pineapple production systems. The survey data indicate that generally, females' participation in pineapple production is low. The majority of the farmers were married, across all the production systems. Most of the pineapple farmers had attained at least basic education. However, the conventional farmers had the highest educational levels. More than half of the farmers under each pineapple production system are engaged in off-farm activity. However, a higher proportion of conventional farmers are engaged in off-farm activity, followed by non-certified organic farmers, with certified organic farmers having the lowest number of farmers engaged in off-farm activity. The average age for certified organic farmers was about 47 years, which is higher than both non-certified and conventional farmers, whose averages were 43 and 41 years, respectively. On average, certified organic farmers have been producing pineapple for about 14 years, while non-certified farmers have been cultivating pineapple for over 10 years. For conventional farmers, they have been producing pineapple for over 7 years. Certified organic farmers have relatively larger households, with 8 people on the average, including 3 people who are able to work on the farm. Conventional farmers had an average of 7 people in the household, out of which 3 are able to help with the farming activities, while non-certified organic farmers had the smallest household size of 6, with 3 persons who can assist them on the farm. Non-certified organic producers obtain a higher average farm income of GH¢ 80.91, followed by certified organic producers with an average farm income of GH¢ 78.30. Conventional farmers had the highest average annual household income and livestock wealth, but non-certified organic producers obtain higher average farm income. In terms of physical assets, certified organic producers have the higher average value. Generally, certified organic producers have higher average total wealth.

Most of the farmers, particularly the certified and non-certified organic farmers, are more concerned with the environment. The financial perception indices (FPI) for all the categories of pineapple farmers were positive; however, conventional farmers had an extremely low FPI.

Conventional farmers had a lower institutional perception index (0.13) than non-certified and certified organic farmers, with indices of 0.30 and 0.40, respectively. The survey data indicate that all the categories of farmers have positive perceptions on the institutional factors, and this suggests that institutional factors are perceived to influence farmers' choice of certified organic production. The majority of pineapple farmers have attended pineapple production training. Although access to organic information seems to be relatively low among conventional farmers, the general impression received is that organic information sources are available to the majority of the pineapple farmers in the region, since the majority (97.5 %) and (88.2 %) of organic and non-certified organic farmers, respectively, have access to organic information, and a substantial amount (45.7 %) of conventional farmers also have access to organic information. Even though farmers' access to credit was low, certified organic farmers had relatively higher access to credit than non-certified and conventional farmers did. The low access to credit is an indication that the pineapple farmers in the study area are credit constrained. Certified organic farmers receive more organic extension services in a production season than those in the other production systems do. Conventional farmers used a higher proportion of hired labour, followed by certified organic farmers, with the lowest being used by non-certified organic farmers.

The social capital level of farmers was measured using structural and cognitive social capital. The cognitive social capital of the certified, non-certified, and conventional farmers was driven by informal associatedness and core trust. The level of cognitive social capital was high for non-certified farmers (39.75), followed by conventional farmers (39.14), and then certified organic farmers with a score of 39.39. Structural social capital is high among certified organic farmers (average score of 28.24) compared with non-certified organic (24.88) and conventional farmers (25.36). The overall social capital index for certified organic farmers was 67.63 and is higher than the overall social capital index for non-certified organic (64.63) and conventional farmers (64.76). However, the social capital index for all the farmer groups was relatively high.

Central Region farmers mostly have access to small landholdings, owing to the forms of tenure system that exist in the region. Conventional farmers cultivated larger pineapple farms than those in the certified and non-certified production systems did. Most production areas in the region are distant from the organic markets. The average distance from certified organic farms to the nearest certified organic market is 0.92 kilometres, which is shorter than the distances from both non-certified organic and conventional farms. As a result, access to organic markets is higher for certified organic farmers, but relatively low for non-certified organic farmers. This

confirms that the distance from farm to organic market influences farmers' access to certified organic markets.

The majority of all the categories of farmers use rented land for pineapple production. Certified organic farmers had the largest number of farmers (32.9 %) having high knowledge about land tenure regulations, followed by non-certified organic farmers (28.9 %), then by the conventional farmers, with 21.4 % of farmers having high knowledge. Certified organic farmers have high knowledge of organic standards and certification, followed by non-certified farmers, then by conventional farmers. All the farmer categories had very low percentages of farmers having high knowledge about the phytosanitary requirements for the importing country. This could be associated with the fact that most of the surveyed farmers are not exporters. Pineapple farmers' knowledge of traditional belief/taboos/norms was high. About 43.0 % of the certified organic farmers had high knowledge in traditional beliefs/taboos/norms, followed by non-certified organic farmers (39.5 %), then by conventional pineapple farmers at 36.4 %. The traditional belief/taboos/norms in the central region of Ghana serve as informal constraint to pineapple farmers' behaviour.

5.3.4 Procedures

The integrated VC-NIE-SCP framework was used in identifying and describing the characteristics and requirements of the different pineapple production systems through qualitative and quantitative description. The framework involves the examination of the three levels of the pineapple value chain (influencers, players and supporters) in four interrelated levels of the sector, namely social embeddedness level, institutional environment-structure level, governance structure-conduct level, and resource allocation-performance level. The social embeddedness level and the institutional environment-structure level were used to examine the value chain influencers of each production system. The level of social embeddedness of farming communities and farmers was analysed using social capital theory. The value chain players were analysed by describing the governance structure-conduct level and resource allocation-performance level of the framework. First, the identification of actors in production systems, which consists of those who are directly involved in moving the pineapple from the input suppliers to the final consumers, were identified. The description of the value chain players of each production system ended with information on resource allocation and performance of the farmers. The last stage of the application of the integrated VC-NIE-SCP framework involved the analysis of value chain supporters. The value chain supporters of each of the identified production systems were only considered up to the extent of their behaviour in supporting pineapple farmers. The application of the integrated VC-NIE-

SCP framework in characterising the different production systems provides a comprehensive description of the production systems at all the three levels: the actors who are involved with moving pineapples from the input suppliers to the final consumer; the social, physical and institutional environments that influence the behaviour of the value chain players; and the support structures that are available to support the pineapple farmers to operate within the environment that was created by the influencers.

In determining and analysing the factors that influence farmers' choice of a particular pineapple production system in Ghana, the multinomial logit model was employed. The multinomial logit model was used because the study identified three production methods and accordingly the binomial logit or probit models which are widely used in analysing adoption choices could not be applied (Green, 2000). Given the nature of the sample, pineapple farmers have three production choices: (i) the conventional pineapple production system (ii) the non-certified organic pineapple production system, and (iii) the certified organic pineapple production system. The conventional pineapple production system was used as the reference category since it is the commonly practised system of production in the study area. The multinomial logit model was used to determine the magnitude and direction of influence that the social, physical and institutional factor and other factors have on farmers' choice of certified organic pineapple production system from among non-certified organic and conventional production systems.

5.4 Results and Conclusion

5.4.1 Characteristics of the Different Pineapple Production Systems in the Pineapple Production Sector

Three main production systems are used by pineapple farmers in the Central Region of Ghana. The three main systems include certified organic, non-certified organic and conventional production systems. The survey data revealed that the majority were practising conventional pineapple production methods, followed by certified organic producers. Non-certified organic farmers were the least in number. Under certified organic pineapple production, males were found to be in the majority. Similarly, most of the non-certified organic and conventional producers were males. Generally, females' participation in pineapple production is low. However, a relatively high percentage of females are associated with non-certified pineapple production. The majority of the farmers in all the categories of production systems were basic school graduates. High proportions of conventional farmers are engaged in off-farm activities, followed by non-certified organic and certified organic farmers,

respectively. On average, certified organic farmers had been producing pineapple for about 14 years, while non-certified farmers had been cultivating pineapple for over 10 years. Conventional farmers had been producing pineapple for over 7 years. Certified organic farmers had relatively larger average households of 8 people with 3 people who are able to work on the farm. Conventional farmers had an average of 7 people in the household, out of which 3 are able to help with the farming activities, while non-certified organic farmers had the smallest household size of 6 people, with 3 persons who could assist them on the farm. The majority of the non-certified and certified organic farmers are moderately concerned with the environment, while few of the conventional farmers are moderately concerned with the environment. All the categories of farmers have positive perceptions towards the financial and institutional aspects of certified organic production. All certified organic farmers (100 %) had attended organic training before. The majority of the non-certified organic farmers (86.8 %) have attained training, and a substantial number (67.1 %) of conventional farmers had also received training. A higher proportion of the certified organic and non-certified organic farmers have access to organic information, while a higher proportion of the conventional farmers have no access to organic information. In terms of access to credit, the majority of all categories farmers had no access to credit

5.4.2 Factors Influencing Farmers' Choice of Pineapple Production System in Ghana

The results from the analysis of the determinants of farmers choice' of certified organic pineapple using the multinomial logit estimates show that adoption of certified organic pineapple production is negatively influenced by senior high school, training college and undergraduate university levels of education, household size, off-farm activity and wealth of farmers among all the personal factors compared to conventional production method. The conclusions from the results are that certified organic pineapple production in the Central Region of Ghana is dominated by farmers with a basic level of education and that an increase in farmers' education reduces growth in the certified organic production sector. In conclusion, participation in off-farm activities, large household size and wealth of farmers hinder the development of the certified organic pineapple production sector.

Regarding the attitudinal and behavioural factors, being highly concerned and concerned about the environment positively influence farmers' choice of certified organic production, compared with conventional production. The conclusion that can be drawn from this is that, if farmers' attitudes can be changed from no concern for the environment to either concerned or highly concerned about the environment effects of their production system, it will increase

the adoption of certified organic pineapple production. Price premiums associated with organic products positively influence farmers' choice of certified organic pineapple production. Farmers' perception about price premiums obtained from certified organic products is a powerful instrument for motivating the adoption of certified organic production in the Central Region of Ghana. The proportion of hired labour to total labour used on a pineapple farm per farming season positively influences farmers' choice of certified organic pineapple production. Contracts with certified organic pineapple exporters or processors positively influence farmers' choice of a certified organic pineapple production system, compared with a conventional production system. The conclusion from this finding is that more farmers will adopt certified organic pineapple production if they enter into contracts with certified organic pineapple exporters or processors. Training on organic production has a positive influence on farmers' choice of certified organic pineapple production. Therefore, it is concluded that organic training has a potential for improving growth in certified organic pineapple adoption. Access to support services from government or NGOs positively influences farmers' choice of certified organic pineapple production. Therefore, support services from government organisations and NGOs are important factors for small-scale farmers' adoption of certified organic production systems. Social capital index positively influences farmers' choice of certified organic pineapple production, compared with conventional production. The conclusion from this finding is that the social environment within which the farmer operates is an important aspect in the farmer's decision-making regarding the adoption of a certified organic pineapple system. On the other hand, farmers' choice of certified organic pineapple production is negatively influenced by access to government-subsidised inputs (Chinp). The conclusion that can be drawn from this is that the supply of subsidised inputs by the Government of Ghana hinders the adoption OF certified organic pineapple production in the Central Region of Ghana.

Among the physical factors, farm size and distance from farm to organic market negatively influence farmers' choice of certified organic pineapple production, compared with conventional production methods. Hence, the larger the farm size is, the higher the likelihood of the farmer choosing conventional production practices will be. Furthermore, it is concluded that there exists a negative relationship between the distance from the farmlands to the organic markets and the farmers' decision to adopt certified organic production. Availability and access to certified organic markets have a positive influence on farmers' choice of a certified organic pineapple production system. Hence, to facilitate the growth of certified organic pineapple production in the Central Region of Ghana, certified organic markets should be made available.

Concerning institutional factors, the results show that the land tenure system plays a significant role in influencing farmers' choice of certified organic production. Specifically, an owned land tenure system has a negative influence on farmers' choice of certified organic pineapple production, compared with conventional production methods, whereas farming on family lands positively influences the adoption of certified organic pineapple production, compared with farmers who farm on rented lands. Low levels of knowledge of land tenure systems have a positive influence on farmers' choice of certified organic pineapple production, compared with conventional production methods. The conclusion from this scenario is that the land tenure systems prevailing in the study area do not favour certified pineapple production, in the sense that farmers who are more knowledgeable about the land tenure system prefer conventional pineapple production.

The level of knowledge of organic standards and regulations has no significant influence on farmers' choice of certified pineapple production, compared with the conventional production method. Interestingly, farmers' level of knowledge of phytosanitary regulations plays a significant role in influencing farmers' choice of certified organic pineapple production. Low knowledge of phytosanitary regulations has a negative influence on farmers' choice of certified organic pineapple production, compared with conventional production methods. Medium knowledge of phytosanitary regulations has a positive influence on farmers' choice of certified pineapple production, compared with the conventional production method. In conclusion, the level of knowledge that a farmer has of phytosanitary regulations is an important institutional factor influencing the adoption of certified organic pineapple production. Finally, farmer's level of knowledge about the traditional norms, taboos and beliefs in the farming communities influences adoption of certified organic pineapple production systems.

For non-certified organic pineapple production, the estimates show that farmers' choice of non-certified organic pineapple production is negatively influenced by senior secondary school, training college and undergraduate university educational levels, number of extension contacts, access to government subsidised inputs, farm size, owned land tenure system and medium level of knowledge on land tenure systems. Farmers who are concerned about the environment, perception of premiums on organic product, perceived high cost of certification and low level of traditional knowledge have positive influences on farmers' choice of non-certified organic pineapple production in the Central Region of Ghana.

5.5 Recommendations

A number of recommendations can be made, based on the findings from this dissertation. This section sets out recommendation for policy makers that might contribute towards uplifting the slow growth and low adoption of certified organic pineapple production in the Central Region of Ghana.

- Policies are required to incentivise formal and informal credit providers to develop financing products that are tailor-made for small-scale pineapple farmers. The very nature of small-scale farming normally excludes these farmers from gaining access to formal and informal credit. Access to credit will allow small-scale farmers to supplement their cash flow, and hence to overcome a major stumbling block that contributes to the exclusion of small-scale farmers from the formal market.

- Government policies and strategies on certified organic pineapple production should target farmers with basic educational level, since farmers with higher educational levels prefer other off-farm activities. However, future strategies could be directed towards convincing farmers with higher education to adopt certified organic production.

- Policies are required to enhance the growth of certified organic production and should focus on influencing farmers to gain positive attitudes towards sustaining the environment. For instance, through creation awareness of the impact of conventional production on the environment and the sustainability potential of certified organic pineapple production.

- Given the nature of the Ghanaian pineapple export and domestic markets, government should regulate the pricing of, or set standard prices for, certified organic pineapples. This will ensure that certified organic farmers obtain high premiums for certified organic pineapples. This will serve as an incentive for the farmers to produce more certified organic pineapple for the export market, which in turn will increase foreign exchange and gross domestic product.

- If the government desires to promote the growth of certified organic pineapple production, then small-scale pineapple farmers should be encouraged to consider contract farming with pineapple export companies or processors.

- The government should consider training for organic farmers as being an integral part of its policy documents and strategies for developing the certified organic pineapple sector in Ghana.

- Government should collaborate with donor agencies, NGOs and other available institutions to provide support services to small-scale pineapple farmers. This will enable the farmers to produce more certified organic pineapple and also attract non-certified or conventional farmers to convert to certified organic pineapple production.

- Given the nature of small-scale pineapple farming in the Central Region of Ghana, collective action promises to be a great tool for allowing small-scale farmers to benefit from economies of scale, and reduce certification and transaction costs faced by buyers who deal with small-scale pineapple farmers. Policies should encourage the establishment of appropriate collective entities among small-scale pineapple farmers as a vehicle that will allow them to gain access to support services and incentives.

- Spot markets should be created in communities where certified organic farms are far away from the certified organic markets.

- Government of Ghana should consider the supply of subsidised organic inputs to certified organic farmers, rather than the general supply of subsidised chemical inputs which negatively influence certified organic farmers' adoption decisions.

- Family ownership of lands should be promoted in the pineapple producing communities, since family land tenure enhances farmers' chances of adopting certified organic pineapple production.

- Farmers should be educated on the phytosanitary regulations and requirements of importing countries. Thus, farmers should be provided with the regulations and requirements of the countries where their certified pineapple is being sold to. This will enable farmers to produce according to the regulations and standards required by the importing countries.

- Traditional rules, norms and beliefs in the pineapple producing communities should be clearly defined for farmers to understand and know the acceptable practices in the community.

REFERENCES

Achaw, M.A (2010). The Impact of large-scale pineapple companies on rural livelihoods in the Akuapim South Municipality of Ghana. Mphil Thesis, Centre for Development and the Environment, University of Oslo Blindern, Norway.

Acheampong, P. P., Braimah, H., Ankomah-Danso, A., and Mochiah, M. B. (2012). Consumers' behaviours and attitudes towards safe vegetables production in Ghana: A Case study of the cities of Kumasi and Cape Coast. *Science Journal of Agricultural Research and Management,* ID sjarm-109, 11 Pages, doi:10.7237/sjarm/109.

Adebiyi, A.J. (2014). Organic agriculture development strategies in Tunisia and Uganda: Lessons for African organics. *Graduate Theses and Dissertations. Paper 13932.* Iowa State University, Centre for Development and the Environment University of Oslo Blindern, Norway.

Adjargo, G. (2012). Social capital: an indispensable resource in Ghana. *Journal of Sustainable Development in Africa,* 14(3): 219-227.

Albisu, L.M. and Laajimi, A. (1998). Technology transfer to Spanish organic farmers: Institutional arrangements, socio-economic issues and policy implications. Newsletter of the European Network for Scientific Research Coordination in Organic Farming, 6th Edition.

Allen, A.J., Reeves, J. and Mumma, G. (1999). Structure, conduct, and performance changes in the U.S. agricultural commodity trucking industry. *Journal of Food Distribution Research,* 30(1): 31-34.

Amare, A. (2010). Analysis of grain marketing in southern zone of Tigray region, Ethiopia. MSc thesis, department of cooperative studies, Mekelle University, Ethiopia.

Amoako, A. E. (2010). Technology for improved income of smallholder pineapple producers, Ghana. Netherlands Development Organisation**.**

Anderson, J. B., Jolly, D. A. and Green, R. (2005). Determinants of farmer adoption of organic production methods in the fresh-market produce sector in California: A logistic regression analysis. *Paper presented at the 2005 annual meeting, July 6-8, 2005, San Francisco, California, Western Agricultural Economics Association.*

Apinga, D. (2011). Profitability of organic and conventional cabbage production in the Afigya Kwabre district. Undergraduate Dissertation, Kwame Nkrumah University of Science and Technology, Ghana.

Asante, K.A and Ntow, W.J. (2009). Status of environmental contamination in Ghana, the perspective of a research scientist. *Interdisciplinary Studies on Environmental Chemistry—Environmental Research in Asia. Eds., Y. Obayashi, T. Isobe, A. Subramanian, S. Suzuki and S. Tanabe, pp 253–260*

Assis, K. and Mohd, I. (2011). Knowledge, attitude and practices of farmers towards organic farming. *International Journal of Ecological Resources*, 2:1-6

Azadi, H., Schoonbeek, S., Mahmoudi, H., Derudder, B., De Maeyer, P., and Witlox, F. (2011). Organic agriculture and sustainable food production system: main potentials. *Agriculture, Ecosystems and Environment*, 144:92–94.

Balamatti, A. M. (2000). Marketing of organic foods in Ghana: perspectives and constraints of Ghana Organic Agriculture Network (GOAN). MSc thesis, International Institute of Management, University of Flensburg, Flensburg.

Bateman, D. (1994). Organic farming and society: An economic perspective. In the economics of organic farming: An international perspective, ed. N. Lampking, and S. Padel, 45–67. Wallingford, Oxon, UK: CAB International.

Batz, F. J, Peters, K. J. and Janssen, W. (1999). The influence of technology characteristics on the rate and speed of adoption. *Agricultural Economics* 21:121-130.

Bello, W. B. (2008). Problems and prospect of organic farming in developing countries. *Ethiopian Journal of Environmental Studies and Management,* 1(1):36–43.

Best, H. (2010). Environmental concern and the adoption of organic agriculture. *Society and natural resources. An International Journal*, 23(5): 451-468. DOI:10.1080/08941920802178206

Beus, C.E. and Dunlap, R.E. (1990). Conventional versus alternative agriculture: the paradigmatic roots of the debate. *Rural Sociology*, 56:32-60.

Beus, E.B. and Dunlap, R.E. (1994). Agricultural paradigms and the practice of agriculture. *Rural Sociology*, 59: 620–635.

Brock, C. (2010). An integrated household economics approach to decision-making: dairy system choice among organic, amish, graziers and conventional farmers in Wisconsin. PhD Thesis, University of Wisconsin-Madison, United States.

Burton, M., Rigby, D. and Young, T. (1999). Analysis of the determinants of adoption of organic horticultural techniques in the UK. *Journal of Agricultural Economics*, 50(1): 47-63

Burton, M., Rigby, D. and Young, T. (2003). Modelling the adoption of organic horticultural technology in the UK using duration analysis. *The Australian Journal of Agricultural and Resource Economics*, 47:29–54.

Calatrava, J. and González, R. (2008). Technical versus institutional innovation in Andalusian olive tree orchards: An adoption modeling analysis. 12th Congress of the European Association of Agricultural Economists, Ghent, Belgium, 26-29 August.

Carambas, M.C. (2005). Economic analysis of eco-labeling in the agricultural sector of Thailand and the Philippines. Doctoral thesis, Faculty of Economics, University of Giessen. Cuvilier Verlag, Göttingen.

Carolyn, P. E. (1999). Attitudes, backgrounds and information preferences of Canadian organic and conventional farmers: implications for organic farming advocacy and extension. *Journal of Sustainable Agriculture,* 13(3): 45-72*.*

Carvalho, P. F. (2006). Agriculture, pesticides, food security and food safety. *Environmental Science and Policy*, 9 (7-8): 685-692. doi:10.1016/j.envsci.2006.08.002

Caswell, M., Fuglie, K.O., Ingram, C., Jans, S. and Kascak, C. (2001). Adoption of agricultural production practices: lessons learned from the US Department of Agriculture Area Studies Project. E.R.S: USDA

Chambers, R. and Conway, G. (1991). Sustainable rural livelihoods: practical concepts for the 21st Century‖, IDS Discussion Paper, no. 296, Institute of Development Studies.

Clark E. E. K, Levy, L. S., Spurgeon, A. and Calvert, I. A. (1997). The problems associated with pesticide use by irrigation workers in Ghana. *Occupational Medicine*, 47(5): 301-308.

Coates, M., Kitchen, R., Kebbell, G., Vignon, C., Guillemain, C. and Hofmeister, R. (2011). Financing agricultural value chains in Africa focus on pineapples, cashews and cocoa in Ghana. Published by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbHdoi:10.1093/occmed

Connor, D. J. (2008). Organic agriculture cannot feed the world. *Field Crops Research,* 106:187-190./47.5.301.

Constance, D. H. and Choi J. Y. (2010).Overcoming the barriers to organic adoption in the United States: a look at pragmatic conventional producers in Texas. *Sustainability* 2: 163-188; doi:10.3390/

Cormack, W. (2000). Energy use in organic farming systems. Norwich, UK: Department for Environment, Food, and Rural Affairs, Norwich University**.**su2010163

Cotula, L. (2006). Key concepts and trends in policy and legislation. In Cotula, L (ed.), Land and water rights in the Sahel. Issue Paper No. 139, International Institute for Environment and Development, London.

Cranfield, J., Henson S. and Holliday, J. (2010). The motives, benefits, and problems of conversion to organic production. *Agricultural Human Values*, 27:291–306DOI 10.1007/s10460-009-9222-9

D'Souza, G., Cyphers, D. and Phipps,T. (1993). Factors affecting the adoption of sustainable agricultural practices. *Agricultural and Resource Economics Review*, 22: 159- 165.

Dabbert, S., Häring, A. M., and Zanoli, R. (2004). Organic farming: policies and prospects. London: Zed Books.

Danielou, M. and C. Ravry (2005). The rise of Ghana's pineapple industry: from successful take off to sustainable expansion, Africa Region Working Paper Series No. 93, World Bank, found in http://www.worldbank.org/afr/wps/wp93.pdf.

Danso, G., Drechsel, P., and Fialor, S. C. (2002). Perceptions of organic agriculture by urban vegetable farmers and consumers in Ghana. *Urban Agriculture-Magazine*, 6:23-24.

Darnhofer, I., Schneeberger, W. and Freyer, B. (2005). Converting or not converting to organic farming in Austria: Farmer types and their rationale. *Agricultural Humanities Values*, 22: 39–52.

Darrah, J. (2015). Personal communication. Ekumfii, Ghana.

De Cock, L. (2005).Determinants of organic farming conversion. *Paper prepared for poster presentation at the XIth International Congress of the European Association of Agricultural Economists (EAAE), 'The Future of Rural Europe in the Global Agri-Food System', Copenhagen, Denmark, August 24-27, 2005.*

Defrancesco, E., Gatto, P., Runge, F. and Trestini, S. (2008). Factors affecting farmers' participation in agri-environmental measures: A northern Italian perspective. *Journal of Agricultural Economics*, 59:114–131.

Diao, X. (2010). Economic importance of agriculture for sustainable development and poverty reduction: findings from a case study of Ghana. Global forum on agriculture. Policies for agricultural development, poverty reduction and food security OECD Headquarters, Paris. Working party on agricultural policy and markets, 15-17 November 2010. TAD/CA/APM/WP (2010)40.

Duram, L.A. (1999). Factors in organic farmers' decision making: Diversity, challenge, obstacles. *American Journal of Alternative Agriculture,* 14 (1):2–9

Fairweather, J.R. (1999). Understanding how farmers choose between organic and conventional production: Results from New Zealand and policy implications. *Agriculture and Human Values* 16: 51–63.

Farnworth, C. and Hutchings, J. (2009). Organic agriculture and women's empowerment. IFOAM, Germany.

Feder, S., Just, R. and Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: a survey. *Economic Development. Cultural Change*, 33: 255–298.

Fertô, I. and Forgács, C. (2002).The choice between conventional and organic farming. A Hungarian example. Applied Studies in Agribusiness and Commerce – Apstract Agroinform Publishing.

Fiankor, J.R., Donkor, A., Lowor S.T. and Yeboah, P. (2011). Agrochemicals and the Ghanaian Environment. *A Review Journal of Environmental Protection*, 2: 221-230 doi:10.4236/jep.2011.23026. http://www.scirp.org/journal/jep.

Flaten, O., Lien, G., Ebbesvik, M., Koesling, M. and Valle, P. (2006). Do the new organic producers differ from the 'old guard'? Empirical results from Norwegian dairy farming. *Renewal Agricultural Food System*, 21:174–182**.**

Fold, N. (2008). Transnational sourcing practices in Ghana's perennial crop sectors. *Journal of Agrarian Change*, 8(1): 94-122.

Fold, N. and Gough, K.V. (2008). From smallholders to transnationals: The impact of changing consumer preferences in the EU on Ghana's pineapple sector, Department of

Geography and Geology, University of Copenhagen, Elsevier Ltd. *Geoforum* 39: 1687–1697.

Food and Agriculture Organisation (FAO)/ World Health Organization (WHO) Codex Alimentarius Commission, (1999). Organic agriculture, Food and Agriculture Organisation of the United Nations, Rome. http://www.fao.org/un fao /bodies/COAG/COAG15/X0075E.htm.

Food and Agriculture Organisation (FAO), (2002). Organic agriculture, environment and food security. FAO

Food and Agriculture Organisation (FAO), (2005). Fertilizer use by crop in Ghana. Rome.

Food and Agriculture Organisation of the United Nations, (FAO) (2009): Project impact study in Ghana; Pineapple, Project —Increasing incomes and food security of small farmers in West and Central Africa through exports of organic and fair-trade tropical products‖, GCP/RAF/404/GER, Food and Agriculture Organization of the United Nations, Rome in ftp://ftp.fao.org/docrep/fao/field/009/ak799e/ak799e00.pdf, 14/03/2010

Gardebroek, C. (2002). Farm-specific factors affecting the choice between conventional and organic dairy farming. *A paper prepared for presentation at the Xth EAAE Congress 'Exploring Diversity in the European Agri-Food System', Zaragoza (Spain), 28-31 August 2002.*

Gardebroek, C. and Jongeneel, R. (2004). The growth in organic agriculture: temporary shift or structural change? *Paper presented at the Annual Meeting of the American Agricultural Economics Association, Denver, USA. August 1-4.*

Genius, M., Christos J. P. and Tzouvelekas V., (2006). Information acquisition and adoption of organic farming practices. *Journal of Agricultural and Resource Economics*, 31(1):93- 113

Ghana Statistical services (GSS) (2008). Ghana living standards survey. Report of the Fifth Round (Glss 5), September 2008.

Ghana Statistical services (GSS) (2012). 2010 Population and Housing Census (PHC): final results, May, 2012.

Ghane, F., Namdar, R. and Chizari, M. (2009). Assesingthe effectiveness of IPM training courses from cotton farmers' perspective in Garamsar County. *Journal of Agricultural Education Management,* 2(1): 10-16

Ghorbani, M., Liaghati, H. and Nemati, F. (2011). Factors influencing the potential demand for credit by farmers on their tendency for producing greenhouse organic cucumbers in Khorasan Razavi Province. *Environmental Sciences*, 8 (3):35–46

Gianessi, L. (2009). The potential for organic agriculture to feed the world is being oversold. Outlooks on pest management, 20(1), pp. 4-5.

Gogoe, S. (2004). Helping smallholders to supply European marketsǁ. *Pesticides News*, 64:12-13. Available at http://www.pan- uk.org/pestnews/Issue/pn64/pn64p12.htm.

Green, W. H. (2000). Econometric analysis, 4th ed. Prentice Hall, Upper Saddle River, New Jersey: Prentice-Hall.

Greene, C., Dimitri, C., Lin, B., McBride, W., Oberholtzer, L. and Smith, T. (2009). Emerging issues in the U.S. Organic industry; Economic information bulletin No. 55; United States Department of agriculture, Economic Research Service: Washington, DC, USA.

Grischow, J.D. (2008) Rural 'community', chiefs and social capital: The case of Southern Ghana. *Journal of Agrarian Change* 8(1), pp 64–93.

Hai, L.T.D. (2003). The organisation of the liberalized rice market in Vietnam. PhD thesis, Rijksuniversiteit, Groningen.

Haines, M. (1982). An introduction to farming systems. Longman Group Limited, New York, 152-172.

Hanson, J. (2003). Farm-level impacts of organic production system, in organisation for economic cooperation and development, ed., Organic agriculture: sustainability, markets and policies. (Wellingford, CABI Publishing).

Harrison, P. (1990). Sustainable growth in African agriculture: Long-term perspective study of sub-Saharan Africa. Volume 2. Washington, D.C.: World Bank.

Hathaway-Jenkins. L. J. A, Godwin R. J. A., Pearce B. B., Sakrabani A. R. and Whitmore A.C. (2010). A comparison between conventional and organic farming practices: Soil hydraulic properties. *Proceedings of the 19th World Congress of Soil Science: Soil solutions for a changing world, Brisbane, Australia, 1-6 August 2010. Symposium 3.1.2 Farm system and environment impacts 2010 pp. 5-8.*

Hattam, C. and Holloway, G. (2004). Adoption of certified organic production: Evidence from Mexico. Working Paper No. 4367, Department of Agricultural and Food Economics, University of Reading, UK.

Hattam, C. E. and Holloway, G. J. (2005). A manuscript on Adoption of Certified Organic Production: Evidence from Mexico. Pp 1-5.

Heaton, S. (2001). Organic farming, food quality, and human health. Bristol, UK: Soil Association.

Heimler, D., Vignolini, P., Arfaioli, P., Isolani L. and Romani A. (2011). Conventional, organic and biodynamic farming: differences in polyphenol content and antioxidant activity of Batavia lettuce. *Journal of the Science of Food and Agriculture* 92(3) pp 551–556.

Hollaway, G., Shankar, B. and Rahman, S. (2002). Bayesian spatial probit estimation: a primer and an application to HYV rice adoption. *Agricultural Economics*, 27:383-402

Holloway, G., C. Nicholson, Delgado, C., Staal, S. and Ehui, S. (2000). Agro-industrialization through institutional innovation transaction costs, cooperatives and milk-market development in the east- African highlands. *Agricultural Economics,* 23: 279–88.

International Fund for Agricultural Development (IFAD), (2003). The adoption of organic agriculture among small farmers in Latin America and the Caribbean: Thematic evaluation. Report No. 1337. Rome: IFAD. Available at Web site http://www.ifad.org/evaluation/publichtml/eksyst/doc/agreement/pl/organic.htm (accessed March 10, 2013).

International Federation of Organic Agriculture Movements (IFOAM) (2003). Organic and like-minded movements in Africa. International Federation of Organic Agriculture Movements (IFOAM), Bonn, pp102–108. Available from F:\Country Profile - Ghana - Organic & Natural Products - International Trade Centre - ITC.htm [Accessed 5 February 2013]

International Federation of Organic Agriculture Movements (IFOAM) (2011). The IFOAM standard for organic production and processing draft version 0.2.http://www.ifoam.org/en/ifoam-standard [Accessed on 12/12/2013].

International Federation of Organic Agriculture Movements (IFOAM) (2004). What is organic agriculture? Germany, Bonn: IFOAM.

IFOAM and FiBL (2006). The world of organic agriculture, statistics and emerging trends 2006. International Federation of Organic Agriculture Movements (IFOAM), Bonn and Research Institute of Organic Agriculture FiBL, Frick, pp. 27–35.

IFOAM and FiBL (2008). The world of organic agriculture, statistics and emerging trends 2008. International Federation of Organic Agriculture Movements (IFOAM), Bonn and Research Institute of Organic Agriculture FiBL.

IFOAM and FiBL (2012). The world of organic agriculture, statistics and emerging trends 2008. International Federation of Organic Agriculture Movements (IFOAM), Bonn and Research Institute of Organic Agriculture FiBL.

IFOAM and FiBL (2014). The world of organic agriculture, statistics and emerging trends 2014. International Federation of Organic Agriculture Movements (IFOAM), Bonn and Research Institute of Organic Agriculture FiBL.

Isgin, T., Bilgic, A., Forster, D.L. and Batte, M. T. (2008). Using count data models to determine the factors affecting farmers' quantity decisions of precision farming technology adoption. *Computers and Electronics in Agriculture*, 62: 231-242.

Isin, F., Cukur, T. and Armagan, G. (2007). Factors affecting the adoption of the organic dried fig agriculture system in Turkey. *Journal of Applied Science*, 7: 748– 754.

Jaeger, P. (2008). Ghana Export horticulture cluster strategic profile study, part i - scoping review, prepared for World Bank Sustainable Development Network (WB-SDN) Africa Region, Agriculture and Rural Development (AFTAR), The Republic of Ghana Ministry of Food and Agriculture, and European Union All ACP Agricultural Commodities Program (EU-AAACP), Accra.

Jansen, H. G. P. (1992). Inter-regional variation in the speed of adoption of modern cereal cultivars in India. *Journal of Agricultural Economics*, 43: 88–95.

Javanmard, M. and Mahmoudi, H. (2008). A SWOT Analysis of organic dried fig production in Iran. *Environmental Sciences,* 6(1):101–110.

Jordaan, H. (2012). New Institutional Economic Analysis of Emerging Irrigation Farmers' Food Value Chains. PhD Thesis, University of the Free State Bloemfontein.

Jordaan, H., Grové, B. and Backeberg, G.R. (2014). Conceptual framework for value chain analysis for poverty alleviation among smallholder farmers. *Agrekon*, 53(1), 1-25.

Kallas, Z., Serra, T. and Gil, J. M. (2009). Farmer's objectives as determinant factors of organic farming adoption. *Paper prepared for presentation at the 113th EAAE Seminar "A resilient European food industry and food chain in a challenging world", Chania, Crete, Greece, date as in: September 3 - 6, 2009*.

Kallas, Z., Serra T. and Gil, J. M. (2010). Farmers' objectives as determinants of organic farming adoption: the case of Catalonian vineyard production. *Agricultural Economics*, 41:409–423.

Kassie, M., Zikhali, P., Manjur, K., and Edwards, S. (2009). Adoption of organic farming techniques evidence from a semi-arid region of Ethiopia, Environment for Development Discussion Paper Series January 2009. Retrieved from web:

Kaufmann, P., Stagl, S. and Franks, D.W. (2009). Simulating the diffusion of organic farming practices in two new EU member States. *Ecological Economics*. 68 (10):2580-2593.

Khaledi, M. (2007). Assessing the barriers to conversion to organic farming: An institutional Analysis. Unpublished report submitted to the Advancing Canadian Agricultural and Agri-Food Saskatchewan (ACAAFS) from the University of Saskatchewan. Pp 1-67.

Khaledi, M.,Weseen, S., Sawyer, E., Ferguson, S. and Gray, R. (2010). Factors influencing partial and complete adoption of organic farming practices in Saskatchewan, Canada. *Canadian Journal of Agricultural Economics*, 58: 37–56. DOI: 10.1111/j.1744-79.

Kisaka-Lwayo, M. (2007). A discriminant analysis of factors associated with the adoption of certified organic farming by smallholder farmers in Kwazulu-Natal, South Africa. *AAAE Conference Proceedings (2007) 411-416.*

Kisaka-Lwayo, M. (2012). Risk preferences and consumption decisions in organic production: The case of KwaZulu-Natal and Eastern Cape Provinces of South Africa. Unpublished PhD Thesis. University of Fort Hare, Alice South Africa.

Kisaka-Lwayo, M. (2008). A discriminant analysis of factors associated with the adoption of certified organic farming by smallholder farmers in Kwazulu-Natal, South Africa. *In No 52155, 2007 Second International Conference, August 20- 22, 2007, Accra, Ghana (pp. 411–416). African Association of Agricultural Economists (AAAE).*

Kleemann, L. (2012) Organic certification, sustainable farming and return on investment: Empirical evidence from Ghana. Dissertation Kiel University, Germany.

Kleemann, L. (2011). Organic pineapple farming in Ghana – A good choice for smallholders. Kiel Working Paper; Kiel Institute for the World Economy. No. 1671 | January 2011

Kleemann L. and Abdulai, A. (2012). Organic Certification, agro- ecological practices and return on investment: Farm level evidence from Ghana. Kiel Working Paper; Kiel Institute for the World Economy. No. 1816| December 2012

Kleemann, L. Abdulai, A. and Buss, M. (2014). Certification and access to export market: adoption and return on investment on organic-certified pineapple farming in Ghana. *World Development,* 64:79-92

Knorr, D. and Watkins, T. R. (Eds) (1984). Alternative in Food Production. New York: Van Nostrand-Reinhold.

Koesling, M., Flaten, O. and Lien, G. (2008). Factors influencing the Conversion to Organic Farming in Norway. *International Journal of Agricultural Resources, Governance and Ecology*, 7: 78–95.

Kothari, C.R. (2004). Research methodology: Methods and techniques. India: New Age Publications.

Krishna, A. and Shrader, E. (2000). Cross cultural measures of social capital: a tool and results from India and Panama. Social capital Initiatives Working Paper No 21. Social Development Department, World Bank, Washington D.C.

Lampkin, N. (1992): Organic farming. Farming Press Books. Ipswich, UK

Läpple D. and Kelley, H. (2010). Understanding farmers' uptake of organic farming: An application of the theory of planned behavior. *The 84th Annual Conference of the Agricultural Economics Society. Edinburgh 29th to 31st March 2010*.

Läpple D. and Van Rensburg, T. (2011). Adoption of organic farming: Are there differences between early and late adoption? *Ecological Economics,* 70:1406–1414

Lapple, D. (2010). Adoption and abandonment of organic farming: An empirical investigation of the Irish dry stock sector. *Journal of Agricultural Economics, 61 (3): 697–714 doi: 10.1111/j.1477-9552.2010.00260.x*

Lindner, R. K. (1987). Adoption and diffusion of technology: An overview. In Champ, B.R., Highly, E. and Remenyi, J.V. (Eds.), Technological change in post-harvest handling and transportation of grains in the humid tropics. ACIAR Proceedings Series, Australian Centre for International Agricultural Research, No. 19.

Lohr, L. and Park, T.A. (2002). Choice of insect management portfolios by organic farmers: lessons and comparative analysis. *Ecological Economics*, 43: 87-99.

Lohr, L. and Salomonsson, L. (2000). Conversion subsidies for organic production: results from Sweden and lesson for the United States. *Agricultural Economics*, 22: 133–146.

Louw, A., Geyser, M., Troskie G., van der Merwe, M., Scheltema, N. and Nicholson, R. (2010). Determining the Factors That Limit Agro-Processing Development in The Maize Milling Industry In Rural Areas In South Africa. Report by Markets and Economics Research center (MERC) for the National Agricultural marketing centre (NAMC), South Africa.

Maddala, G.S., (1999), "On the Use of Panel Data Methods with Cross Country Data," Annales d'Economie et de Statistique, 55-56, 429-448.

Mahboubi, M. R. and Keshnizi, M. (2010). Comparative analysis of rural women and men's dedication to soil conservation ethnics, case study: Safi-Abad Golestan Province. The 3rd Congress on Agricultural and Natural Resources Extension and Education, Mashhad, Iran, March 2–3, 2010.

Mahdavi-Damghani, A. (2007). Organic farming in iran: opportunities and challenges of certification, education and development. Tropentag Congress on Utilization of Diversity in Land use Systems: Sustainable and Organic Approaches to Meet Human Needs, Witzenhausen, Germany, October 9–11, 2007.

Michelsen, J., Lynggaard, K., Padel, S. and Foster, C (2001). Organic farming development and agricultural institutions in Europe: A study of six countries. Organic farming in Europe: Economics and Policy volume 9: 3-21. University of Hohenheim, Stuttgart-Hohenheim.

Midmore, P. (1994). Input-output modeling of organic farming and the rural economy of England and Wales. In The economics of organic farming: An international perspective, ed. N. Lampking, and S. Padel, 361–370. Wallingford, Oxon, UK: CAB International.

Milagrosa, A. (2007a). Institutional economic analysis of vegetable production and marketing in Northern Philippines: Social capital, institutions and governance. PhD thesis. Wageningen University.

Milagrosa, A. (2007b). Social capital, ethnicity and decision-making in the Philippine vegetable market. ZEF – Discussion papers on Development policy, Bonn, September 2007.

Milagrosa, A. and Slangen, L.H.G. (2005). The social capital of indigenous agricultural communities in Benguet, northern Philippines: Socio-cultural implications and consequences to local vegetable trade. *Paper prepared for the RESPONSE Workshop, December 2005, Wageningen, The Netherlands.*

Ministry of Agriculture and Fisheries (MAF) (1994). A review of the environmental/public good costs and benefits of organic farming and an assessment of how far these can be incorporated into marketable benefits. Wellington, New Zealand: Ministry of Agriculture and Forestry.

Ministry of Food and Agriculture (MoFA) (2002). Food and Agriculture Sector Development Policy (FASDEP I). Accra: Republic of Ghana 2002.

Ministry of Food and Agriculture (MoFA) (2007). Food and Agriculture Sector Development Policy (FASDEP II). Accra: Republic of Ghana 2007.

Naik, M. H., Srivastava, S.R., Godara, A. K. and Yadav, V.P S. (2009). Knowledge level about organic farming in Haryana. *Indian Resource Journal Extension Education*. 9 (1):50-53.

Niemeyer, K., and Lombard, J. (2003). Identifying problems and potential of the conversion to organic farming in South Africa. http://www.organicagcentre.ca DOCs/res_policy_Niemeyer.pdf. Accessed 23 Dec 2013.

Ninson, D. (2012). Analysis of Pineapple Production in the Akwapim South Area of Ghana. Dissertation, Department of Agricultural Economics and Agribusiness, College of Agriculture and Consumer Sciences, University Of Ghana, Legon.

North, D.C. (1994). Institutions Matter. In Jordan, H. (eds) 2012. New institutional economic analysis of emerging irrigation farmers' food value Chains. PhD Thesis, University of the Free State Bloemfontein.

Offermann, F., Nieberg, H., and Zander, K. (2009). Dependency of organic farms on direct payments in selected eu member states: today and tomorrow. *Food Policy*, 34(3), 273–279.

Omani, A.R. and Chizari, M. (2011). Identifying the appropriate model for anticipating adoption model for sustainable management of water resources among wheat farmers of Ahvaz Province. *Journal of Agricultural Economy and Development*, 19(73):77–100.

Osei-Asare, Y.B. (2009). Status of organic agriculture in Ghana: a survey of consumers, producers and marketers. An FAO/GOAN/ MOFA Project on Organic and Fair Trade Export from Africa.

Overseas Development Institute (ODI) (2011). Ghana's sustained agricultural growth: Putting underused resources to work. ODI publications, 111 Westminster Bridge Road, London SE1 7JD, UK

Owusu, V. and Anifori, M. O. (2012). Assessing consumer willingness to pay a premium for organic food product: evidence from Ghana. Selected Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.

Owusu, V., and Anifori, M. (2013). Consumer willingness to pay a premium for organic fruit and vegetable in Ghana. *International Food and Agribusiness Management Association*, 16(1): 67–86.

Owusu-Boateng,G. and Amuzu, K. K., (2013). A survey of some critical issues in vegetable crops farming along River Oyansia in Opeibea and Dzorwulu, Accra-Ghana. *Global Advanced Research Journal of Physical and Applied Sciences*, 2 (2): 24-31.

Pacini, C., Wossink, A., Giesen, G., Vazzana, C. and Huirne. R. (2003). Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis. *Agriculture, Ecosystems and Environment,* 95(1):273–288. doi:10.1016/S0167-8809(02)00091-9

Padel, S. (2001). Conversion to organic farming: A typical example of the diffusion of an innovation? *Sociologia Ruralis* 41(1): 40–61.

Parra López C. P. and Calatrava Requena J., (2005). Factors related to the adoption of organic farming in Spanish olive orchards Spanish. *Journal of Agricultural Research*, 3(1), 5-16

Parrott, N., J.E. Olesen and H. Høgh-Jensen (2006). Certified and non-certified organic farming in the developing world" in N. Halberg and others, eds., Global Development of Organic Agriculture: Challenges and Prospects (Oxfordshire, CABI publishing), pp. 153-177.

Parrott, N., Sockyew A., C., Makunike, C. and Ntambi, S.N. (2006). Organic farming in Africa. In: Helga, W. and M. Yussefi (eds). The world of organic farming agriculture: statistics and emerging trends. A joint Publication of International Federation of Organic

Agricuture movement, Bonn, Germany and research Institute of organic agriculture (FiBl) Frick Switzerland.farming technologies in Finland. *European Review of Agricultural Economics*, 28: 1–15.

Pastor, F., Legaspi, N., Agbigay,L., Pastor, C. D., Salas, M. A., Cacatian, M. and De Padua, M. V. (2011). Farmers' Attitudes and Level of Knowledge on organic Farming in the Ilocos Region, Philippines. In D. Neuhoff, N. Halberg, I. A. Rasmussen, J. Hermansen, C. Ssekyewa, and S. M. Sohn (Eds.), Organic is Life – Knowledge for Tomorrow. Proceedingsof the Third Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR) (pp. 161–164). University of Bonn/Germany.

Pattanapant, A., and Shivakoti, G. P. (2009). Opportunities and constraints of organic agriculture in Chiang Mai Province, Thailand. *Asia-Pacific Development Journal*, 16 (1): 115-147.

Pietola, K.S. and Oude-Lansink, A. (2001).Farmer response to policies promoting organic farming technology in Finland. *European review of agricultural economics* 28(1) pp 1-15.

Pikins, G. (2015). Personal communication. Komenda Edina Eguafo Abirem, Ghana.

Pomeroy, R.S. and Trinidad A.C. (1995). Industrial Organization and Market Analysis: Fish Marketing. In Scott, G. J. (Ed). Price, Product and People: Analyzing Agricultural Markets in developing countries. Lynne Rienner Publishers Inc., Boulder, Colorado.

Poudela, D.D., Horwathb, W.R., Laninic, W.T., Templed, S.R., van Bruggen, A.H.C., (2002). Comparison of soil N availability and leaching potential, crop yields and weeds in organic, low-input and conventional farming systems in northern California. Agriculture*, Ecosystems and Environment,* 90: 125–137.

Pretty, J. and Hugh Ward, H. (2001) Social capital and the Environment. World Development 29(2), pp 209–227.

Putnam, R. (1993). Bowling alone: Collapse and revival of American community. In Jordan, H. (eds) (2012). New institutional economic analysis of emerging irrigation farmers' food value chains. PhD Thesis, University of the Free State Bloemfontein.

Radwan A., Gil J. M., Diab, Y. A. A. and Abo-Nahoul, M. A. (2011). Determinants of the adaption of organic agriculture in Egypt using a duration analysis technique. Department of Agricultural Economics, Faculty of Agriculture, Cairo University, Cairo,

Egypt.Department of Agricultural Economics, Faculty of Agriculture, Assiut University, Assiut, Egypt.

Razzaghi-Borkhani, F., Rezvanfar, A. and Shabanali Fami, H. (2010).The role of educational and communicational factors on the knowledge of Integrated Pest Management (IPM) among paddy farmers in Sari County. *Journal of Agricultural Education Management Research*, 13: 2–17.

Reddy B. S. (2010). Organic Farming: status, issues and prospects – A Review. *Agricultural Economics Research Review*, 23: 343-358.

Reeve, I. (1990). Sustainable agriculture: Ecological imperative or economic impossibility? - A review of overseas government policy and implications for Australian agriculture Prepared for the Rural Development Centre, University of New England, Armidale.

Rezvanfar, A., Eraktan, G. and Olhan, E. (2011). Determine of factors associated with the adoption of organic agriculture among small farmers in Iran. *African Journal of Agricultural Research* 6(13):2950–2956.

Ricker, H. (1997). The Economics of organic farming-An international perspective. American Journal of Agricultural Economics, 79 (1), 280-283.

Rigby, D. and Ca´ceres, D., (2001). Organic farming and the sustainability of agricultural systems. Agricultural Systems 68 (1), 21–40.

Rigby, D. and Young, T., (2000). Why do some agricultural producers abandon organic production systems? An exploration of UK data, School of Economic Studies, University of Manchester, Discussion Paper 0015, September.

Rigby D., Young T. and Burton, M. (2001).The development of and prospects for organic farming in the UK. *Food Policy,* 26: 599–613

Roduner, D., (2007). Donor Interventions in Value Chain Development. 1st Edition.

Saha, A., Love, H.A., Schwart, R., (1994). Adoption of emerging technologies under output uncertainty. *American Journal Agricultural Economics,* 76: 836-846.

Saker M.A., Itohara Y. and Hoque M. (2010).Determinants of adoption decisions: The case of organic farming (OF) in Bangladesh. *Extension Farming Systems Journal*, 5 (2): 39-46

Schneeberger, W., Darnhofer, I. and Eder, M. (2002). Barriers to the adoption of organic farming by cash crop producers in Austria. *American Journal of Alternative Agriculture* 17(1): 24–31.

Serra, T., Zilberman, D. and Gil, J.M. (2008), Differential uncertainties and risk attitudes between conventional and organic producers. The case of Spanish COP farmers. *Agricultural Economics*, 39(2): 219 - 229

Setboonsarng, S., Leung, P.S. and Cai, J. (2005). Contract farming and poverty reduction: the case of organic rice contract farming in Thailand", Asian Development Bank Institute Discussion Paper No. 49 (Tokyo, Asian Development Bank Institute).

Sharifi, O., Sadati, S., RostamiGhobadi, F., Sadati, A., Mohamadi, Y., and Tolou Del, P. (2010). Barriers to conversion to organic farming: A case study in BabolCounty in Iran. *African Journal of Agricultural Research,* 5 (16):2260–2267.

Soltani S., Azadi H., Mahmoudi, H., and Witlox, F. (2013).Organic agriculture in Iran: Farmers' barriers to and factors influencing adoption. *Renewable Agriculture and Food Systems*: 1-9. doi:10.1017/S1742170513000069

Staal, SJ, Baltenweck, I., Waithaka, M.M., de Wolff, T. and Njoroge, L. (2002). Location and uptake: Integrated household and GIS analysis of technology adoption and land use, with application to smallholder dairy farms in Kenya. Journal of Agricultural Economics, 27:295–315.

Staal, S., Delgado, C. and Nicholson, C. (1997). Smallholder dairy under transactions costs in east Africa. World Development 25 (5): 779–94.

Statistics, Research and Information Directorate (SRID) (2011). Agriculture in Ghana; Facts and Figure 2010. Ministry of Food and Agriculture, May 2011.

Stolze, M., A. Piorr, Ha¨ring, A. and Dabbert, S. (2000). The environmental impacts of organic farming in Europe. Organic farming in Europe. *Economics and Policy*, Vol. 6. Hohenheim, Germany: Universita¨tHohenheim.

Suzuki, A., Jarvis, L.M., and Sexton, R.J. (2008). Rejection of purchase: an empirical study o n contract farming in the pineapple industry in Ghana. Paper presented at the Econo mic Development in Africa, Center for the Study of African Economics Conference 2 008, Oxford University**.**

Svotwa, E., Baipai, R. and Jiyane, J. (2009). Organic farming in the smallholder farming sector of Zimbabwe. *Journal of Organic Systems*, 4:8–14.

Takane, T. (2004). Smallholders and non-traditional exports under economic liberalization – the case of pineapple in Ghana Institute of Developing Economies, African Study Monographs, 25(1): 29-43, March 2004 (Found in http://repository.kulib.kyoto-u.ac.jp/dspace/bitstream/2433/68228/1/ASM_25_29.pdf, 08.05.2009)

Tariq, M.I., Afzal, S., Hussain, I. and Sultana, N. (2007). Pesticides exposure in Pakistan: A Review. *Environment International Journal*, 33(8), 1107–1122.

Thamaga-Chitja, J. and Hendriks, S. L. (2008). Emerging issues in smallholder organic production and marketing in South Africa. *Development Southern Africa*, 25(3):317–326.

Thapa G. B. and Rattanasuteerakul K., (2011). Adoption and extent of organic vegetable farming in Mahasarakham province, Thailand. *Applied Geography* 31: 201-209.

Tiku, N. E., Olukosi, J. O., Omolehin, R. A. and Oniah, M. O. (2012). The structure, conduct and performance of palm oil marketing in Cross River State, Nigeria. Journal of Agricultural Extension and Rural Development 4(20), pp. 569-573.

Torres A. P., Marshall, M. I. and Alexander E. C. (2013). Does proximity determine organic certification among farmers using organic practices? *Selected paper prepared for presentation at the Agricultural & Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013.*

Tran, N. D. (2009). Transition to organic tea production in Thai Nguyen Province, Vietnam: Economic and environmental impacts. Research Report No. 2008-RR8. Economy and Environment Program for Southeast Asia (EEPSEA), Singapore

United Nations Conference on Trade and Development (UNCTAD), (2003) Organic fruits and vegetables from the tropics. Market, certification and production information for producers and international trading companies. United States and Geneva 2003. UNCTAD/DITC/COM/2003/2

United State Agency for International Development (USAID) (2012). Trade and Investment Program for a Competitive Export Economy in Ghana: A Synthesis of Findings. Policy Brief, January 2012.

Vanslembrouck, I., van Huylenbroeck, G. and Verbeke, W. (2002). Determinants of the willingness of Belgian farmers to participate in agri-environmental measures', *Journal of Agricultural Economics,* 53: 489–511

Verbeek, M. (2008). A guide to modern econometrics. John Wiley and Sons Ltd.

Wallace, J. (2001) Organic field crop handbook. Canadian Organic Growers Inc., Second edition.

Williamson, O.E. (2000).The new institutional economics: Taking Stock, Looking Ahead. *Journal of Economic Literature*, 38: 595–613

Williamson, O.E. (1998). Transaction cost economics: How it works; where it is headed. De Economist, 146:23-58. In Jordaan, H., Grové, B. and Backeberg, G.R. (eds) 2014. Conceptual framework for value chain analysis for poverty alleviation among smallholder farmers. Agrekon.

Williamson, O.E. (1985). The economic institutions of capitalism: firms, markets, relational contracting. New York: Free Press.

World Development Indicators (WDI) (2011).The World Bank.

Worthington, V. (2001). Nutritional quality of organic versus conventional fruits, vegetables, and grains. *Journal of Alternative and Complimentary Medicine* 7(2): 161–173.

Yankson, E. (2015). Personal communication. Awutu Senya West, Ghana.

Zakari, K.A., (2012). National mango study. PACT II program and the International Trade Centre (Geneva).

APPENDIX A: QUESTIONNAIRE

UNIVERSITY OF THE FREE STATE, BLOEMFONTEIN
DEPARTMENT OF AGRICULTURAL ECONOMICS
QUESTIONNAIRE FOR FARMERS

"**Factors affecting adoption of alternative pineapple production systems in Ghana"**
Name of the Enumerator …….. Enumerator Contact Number ……...
District …….. Community …….....
Questionnaire Number ……... Respondent Contact Number ……
Date of interview: DD /MM /2015 ,

Section A: Personal Characteristics

1. Category of farmer you are interviewing: Certified Organic [ ] Non-Certified Organic [ ] Conventional Farmer [ ] other ……..
2. Age of respondent ……years
3. Gender of respondent: Male [ ] Female [ ]
4. Marital Status: Married [ ] Single [ ]
5. What is your highest level of formal education: No formal education [ ] Basic (Primary /JHS) [ ] SSS/SHS [ ] Training College /polytechnic [ ] University (Undergraduate) [ ] Postgraduate [ ] Others (specify) ……
6. How many years have you been cultivating pineapple ……..?
7. What is your household size ……how many can work on the farm ……?
8. Household annual income in Ghana cedis …….
9. What proportion of your household annual income from farming activities? ……. %
10. Are you engage in any off-farm activity? Yes [ ] No [ ]
11. Wealth of farmers

Livestock wealth (2014)

Assets	Quantity in stock	Quantity sold	Quantity consumed	Unit price (Gh¢)
Cattle				
Sheep				
goats				
pigs				
rabbits				
Chicken				
Guinea fowls				
Other				

Household physical assets (2014)

Physical Assets	Quantity	Unit price (Gh¢)
Cement block building		
Mud-bricks building		
Television		

Radio set		
Bicycle		
Motor car		
Motor bike		
Tractor		
Hoe		
Cutlass		
Knapsack sprayer		
Head pans		
Mattock		
Other 1		

Section B: Attitudinal and behavioural Factor

1. On a scale of 1-5 what is your level of concern for the environment in your farming activities or production practices? Not concern [ ] Concern [ ] Somewhat concerned [ ] moderately Concerned [ ] Highly Concerned [ ]

2. Please tick the perception statement(s) that apply to you (1= Strongly agree, 2=Agree, 3= Neutral, 4=Disagree, 5= Strongly disagree

Perception	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Your current production is easily convertible to certified organic production system					
Your previous production was easily convertible to certified organic production system					
Organic pineapple products attracts higher price premium					
Cost of certification for organic pineapple farming is high					
Certified organic pineapple production is more profitable than conventional pineapple production					
Absence of local organic regulations and certification bodies prevents farmers from adopting certified organic pineapple production system					
The land rights and policy favours organic pineapple production					
The small organic market favour organic pineapple production					
Standards and requirements for producing certified organic pineapples are strict and difficult to meet					
Favourable conventional production policies does not favour certified organic pineapple production					

3. Risk attitude

   i. The following scenarios represent the outcomes from a game played by tossing up a coin. The coin can either land on heads, or tail. Please choose the game that you would like to play.

Game	Amount to be won if	
	Heads	Tails
0	GH¢50	GH¢50
A	GH¢45	GH¢95
B	GH¢40	GH¢120
C	GH¢30	GH¢150
D	GH¢10	GH¢190
E	GH¢0	GH¢200

   ii. Given the game you've chosen to play in the previous question, please indicate how much do I have to pay you not to play the game but rather to take the money I offer you?

	0	A	B	C	D	E
1		GH¢50	GH¢63	GH¢72	GH¢83	GH¢100
2		GH¢53	GH¢65	GH¢75	GH¢87	GH¢140
3		GH¢56	GH¢67	GH¢77	GH¢91	GH¢180
4		GH¢59	GH¢69	GH¢80	GH¢95	GH¢220
5		GH¢62	GH¢71	GH¢82	GH¢99	GH¢250

   iii. Compared to other household decision makers in the region, are you more likely, less likely or equally likely to take risks? Same [ ] Less [ ] Greater [ ]

4. Which source of farm labour do you use in your pineapple production? Family labour [ ] hired labour [ ] Nnoboa (cooperative) [ ] other [ ] if other please specify ……
5. Do you have a contract with any organic pineapple export buying or processing companies? Yes[ ] No [ ]
6. If yes, is the contract written or oral? Written [ ] Oral [ ]
7. If yes what are the specifications of the contract? ……..
   ……
8. How many organic extension contacts do you receive in a production season? …….
9. Have you attended any training on pineapple production and marketing? Yes [ ] No [ ]
10. If yes was the training on organic or conventional production system? Organic production system [ ] Conventional production system [ ] Both organic and conventional production system [ ]

11. How many times have you receive training on the above production systems since 2012. Please put the number of times in the box. Organic production system [ ] Conventional production system [ ]
12. Do you have access to production and marketing information on organic agriculture? Yes [ ] No [ ]
13. If yes, what are the sources of this information? Radio [ ] Print media (Newspaper, books, pamphlets etc.) [ ] Television [ ] Friends/relatives [ ] Farmers [ ] Local agricultural authorities (e.g. Extension agent) [ ] Universities [ ] FBO [ ] certification body [ ] private firms (exporters) [ ] internet [ ] Cell phone [ ] others please specify ……..

14. Access to credit

Type of credit	Form of credit		On a scale of 1-5 what was the Difficulty in accessing credit					Amount of credit received in GHc
	Cash	Inputs	1	2	3	4	5	
Formal (formal lending institution)								
Informal (family, friends etc.)								

15. Do you have access to the government of Ghana subsidized agrochemicals/inputs? Yes [ ] No [ ]
16. Do you have access to any institutional support or motivation from Government or NGO's? Yes [ ] No [ ]

    If yes, which form of institutional supports do you receive? Advisory service [ ] certification [ ] inputs [ ] others please specify ……...
17. Apart from the extension officers which other organisations normally provide you with advice and/or assistance with regard to pineapple production? Input suppliers [ ] Buyers [ ] Research institutes [ ] other farmers [ ] Cooperative [ ] Private consultants [ ] None [ ]

Section C: Social Factor

18. Social capital

    A) Please indicate on a scale from 1 to 5 (1= strongly disagree, 2=Disagree, 3= Neutral, 4=Agree, 5= strongly agree) the level to which you agree with the following statements

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Optimism and Satisfaction					
My life will get even better in the future					
I would not be farming if I have an alternative source of income.					
I am happy and satisfied with my life					
I am willing to take more risk than other farmers in my community					

I am willing to forgo a profit opportunity in the short run for the ability to benefit from potential profit opportunities in the long run.					
Trust					
Generally speaking, do you agree most people could be trusted					
I can safely say I am trustworthy					
I trust my family and friends					
I trust the church and its people					
I trust other farmers					
I trust the legal system					
I trust the police					
I trust management of the pineapple processing or export companies					
I trust the media and local information centers					
I trust the district agricultural office and its policies towards agriculture					
I trust local government **(**traditional authorities**)** as agents of development					
Board members in group association are more likely to take advantage of me or other farmers to achieve their personal goal if they get the chance.					
I feel safe in my neighbourhood because a misplaced item is likely to be return					
Networks and social participation					
I get along well with my family					
I get along well with my friends					
I get along well with people in my community					
I get along well with other farmers					
I participate actively in communal labour					
I participate actively in festivals and other Community groupings					
Reciprocity, Exchange and Cooperation					
Most people in the community are concern of issues that are not relate to only themselves and therefore are willing to help if I or someone need it					
I have exchanged planting materials with other farmers in the past					
I have engaged in mutual exchanges with other community members					
I will lend money to my neighbour if he/she needs it to see a doctor					
I will support and contribute financially to community project that might not benefit me most, but benefit other villagers					
I will contribute financially to my farmer group activities when need be					

B). Please indicate whether you are a member of the following types of organisations

Membership in organisations	Non member	Inactive member	Active member
Religious / Church group			
Political party or group			
Farmers' cooperative/Association			
Local government			
Farmer study group			
Community committees (neighbourhood watch group)			
Funeral associations			
Informal savings and credit (susu group)			

Section C: Physical Factors

19. What is your total agricultural land/plot (for all crops) in acres? …….

Please provide information below **(Jan-2012 to Dec-2014)**

Plot number	Total area under pineapple in acres	Age of pineapple	Area harvested in (acre)	Type of production system			Cost of land/acre/annum (GH¢)
				Certified organic	Non-certified organic	Conventional	
1							
2							
3							
4							
5							

20. Do you have access to any organic marketing channel (input and output)? Yes [ ] No [ ]
21. If yes is the market readily available? Yes [ ] No [ ]
22. Which marketing channel best describes the channel within which you participate?

Farmer- Large farmer / exporter-export market consumer [ ]

Farmer-processor -consumer [ ]

Farmer- wholesaler-retail- consumer [ ]

Farmer-processor –export market consumer [ ]

Farmer –consumer (farm gate) [ ]

23. What is the distance from your farm to certified organic market ……(m/km/miles)
24. What is the distance from your farm to conventional market …… (m/km/miles)
25. Please indicate on a scale from 1 to 5 the level to which you agree with the following statements (1= Strongly agree, 2=Agree, 3= Neutral, 4=Disagree, 5= Strongly disagree)

Statement	Strongly disagree	disagree	Neutral	agree	Strongly agree
In general the road network in the region is of a good quality					
In general the infrastructure at the input suppliers is of good quality					

In general the infrastructure at the market is of good quality					

Section D: institutional Factors

26. What is the land tenure arrangement for the pineapple farms/plots?

Plot number	Land tenure (Please tick the land tenure system appropriate for your plots)					
	Own	Rented	Clan	Family	Sharecropping	Borrowed
1						
2						
3						
4						
5						

27. Please indicate on a scale from 1-5 the extent you know the following institutions in the Ghanaian pineapple industry (1–no knowledge all, 2–low knowledge, 3–somewhat , 4–moderate knowledge, 5–high knowledge)

Institutions	No knowl	Low knowl	somewhat	Moderate knowl	High knowl
Land tenure regulations					
Organic standards and regulations					
GlobalGap standards and regulations					
Ghana GAP regulations and standards for pineapple					
Ghana export promotion guidelines					
Phyto sanitory requirments for importing country					
Domestic food safety regulations inplace for chemical usage					
Traditional belief/taboos/norms					
FBO/cooperative laws/rules					

Section E: Production activity

28. Please complete the following table with regard to production during the **(Jan-2012 to Dec-2014)** season.

Pineapple variety		Volume harvested	Quantity consumed/gift	Quantity sold	Price/kg (GHC)	Total price (GHC)
Md2	Fruits					
	Slips					
Smooth cayenne	Fruits					
	Slips					
Sugarloaf	Fruits					
	Slips					

29. Indicate the type, number of labour, rate paid (Man-days) and proportion of hired labour used, during production period? **(Jan-2012 to Dec-2014)**

Production activity	Manual (Ma) or Mechanic-al (Me)	Type and amount of labour used					Labour cost (GH¢)		Machi-nery Cost (GH¢)
		Family	Hired	Nnoboa (coopera-tive)	% of hired labour	Number of days used	Cash	Food	
Land Preparation									
Clearing									
Stumping									
Ploughing									
Harrowing									
Ridging									
Mulching(P)									
Planting Material and Planting									
Grading Suck									
Dipping									
Planting									
Fertilizer Application									
1st round									
2nd round									
3rd round									
4th round									
5th round									
6th round									
7th round									
8th round									
Weed Control									
1st Herbicide application									
2nd Herbicide application									
3rd Herbicide application									
4th Herbicide application									
1st Weeding									
2nd Weeding									
3rd Weeding									
4th Weeding									
5th Weeding									
6th Weeding									
7th Weeding									
8th weeding									
Insects and Pest control									
1st round									
2nd round									
3rd round									
4th round									
Forcing (Flower Induction)									
1st round									
2nd round									
Water fetching									
Dipping									

Herbicide ap									
Fertilizer app									
Fungicide or pesticide app									
Forcing									
Harvesting									
Fruits									
Slips									
Transporting									

30. Please indicate the amount of the respective variable inputs you've used for your **(Jan-2012 to Dec-2014)** pineapple production and how much you spent on the respective inputs.

Items	Specify	Quantity/acre	Units	Amount spent on input per unit (GHC)	Total amount spent on input(GHC)
Suckers					
Plastic mulch					
Water					
Certification cost					
Protective clothing					
	Gloves				
	Boots				
	Nose mask				
	Rain coat				
Conventional Inputs					
Fertilizer 1st	Specify: urea				
2nd	NPK				
3rd					
4th					
Insecticide 1st round	Specify: Dursban				
2nd					
3rd					
Fungicide 1st round	Specify: Alliet				
2nd round					
Herbicide 1st	Specify: Diu-ron				
2nd	Gallant				
3rd	Haverest				
4th					
Calcium Carbide					
Organic Inputs					
Fertilizer 1st	Compost				
2nd	Manure (poultry, cow or sheep and goats)				
3rd					
Insecticide 1st	Greenok				
2nd					
Ethylene gas					
Other					
Other					

Other					

31. Please indicate the number and amount of the respective fixed inputs used. **(Jan-2012 to Dec-2014)**

Type of Machinery and Equipment	Number on farm	Unit cost (GHC)	Total cost (GHC)	Year of purchase	Useful life
Tractor					
Hoe					
cutlass					
Head pans					
Knapsack sprayer					
Other					
Other					
Other					

What was your total cost (variable +fixed) for pineapple production during the **(Jan-2012 to Dec-2014)** season? GHC ……

APPENDIX B: FORMULAS USED FOR CALCULATING COGNITIVE AND STRUCTURAL SOCIAL CAPITAL

FORMULAS USED FOR CALCULATING COGNITIVE AND STRUCTURAL SOCIAL CAPITAL

1. Cognitive Social Capital

$$CSC_i = \sum_{j=1}^{J} \left(\frac{\left(\sum SCIndicator_{ji} \right) - 1}{J} * wgw_i \right)$$

$$j = 1...., J$$

where CSC_i is the cognitive social capital of respondent i; $SCIndicator_{ji}$ is the score for social capital indicator j for respondent i; J is total number of indicators (dimensions) and wgw_i is the within group weight which depends on the number of items included in the measurement of the specific indicator.

2. Structural Social Capital

$$SSC_i = \sum_{i=1}^{8} membership_i$$

where SSC_i refers to the structural social capital of farmer i and $membership_i$ refers to membership of farmer i to the various organisations presented in the questionnaire.

3. Social Capital Index

$$SCI_i = CSC_i + SSC_i$$

where SCI_i is the social capital index of respondent i, CSC_i is the cognitive social capital of farmer i, and SSC_i is the structural social capital of respondent i.

APPENDIX C: PRINCIPAL COMPONENT TEST STATISTICS

PRINCIPAL COMPONENT TEST STATISTICS

Table 1. Principal component statistic for verification and deriving factor model

Test statistic		Value
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		0.879
Bartlett's Test of Sphericity	Approx. Chi-Square	2363.957
	df	171
	Sig.	0.000
Number of component extracted		5
Rotation Sums of Squared loading	Cumulative %	64.781