SOCIO-ECONOMIC DETERMINANTS OF DIVERSIFICATION BEHAVIOUR OF COCOA PRODUCERS IN THE ASHANTI REGION

BY

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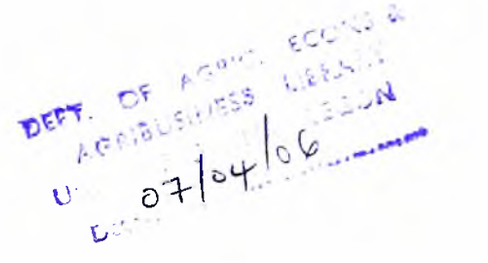

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DEDICATION

To the Almighty God, in whom I trusted and depended upon throughout my study.

DECLARATION

I, Theodora Akweley Tetteh, the author of this thesis, ''Socio-Economic determinants of diversification behaviour of cocoa producers in the Ashanti Region", do hereby declare that with the exception of references to past and current literature cited, the entire research leading to this thesis was carried out by me at the Department of Agricultural Economics and Agribusiness of the Faculty of Agriculture, University of Ghana, Legon. This work has never been presented either in whole or in part for any degree in this University or elsewhere.

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ABSTRACT

The study analyses the effect of the socio-economic determinants on diversification behaviour of cocoa producers herein referred to as 'producers,' in the Ashanti Region of Ghana. The Logit model was employed in the study, which identifies the reasons for diversification into other perennial and annual crops, animal production and off-farm activities. The constraints faced by producers in diversifying, as ranked by the producers, are also analysed. Three hundred and four producers are sampled randomly from five cocoa growing districts in the region, namely Juaso, Nkawie, Tepa, Fumso and Obuasi. The study observes that 5.92 percent of the producers sampled do not diversify at all and cultivate only cocoa while the rest of the producers diversify. The study observes that the prime reason for diversifying is to increase cocoa producer income. The significant socio-economic determinants of diversification include access to infrastructure (primary education, telecommunication facilities, postal services and health services), age of cocoa trees, number of dependants of the producer and size of cocoa farm. This study recommends, inter alia, the provision of infrastructure to cocoa growing areas in order to enhance diversification since it is a means for increasing farmer income. Producers in all forms of diversification activities face the constraint of capital inadequacy. This study further suggests a provision of both financial and material capital to cocoa producers who desire to diversify. The study finally makes suggestions for future research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

GOG	Government of Ghana
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
ISSER	Institute of Statistical, Social and Economic Research
MOFA	Ministry of Food and Agriculture

CHAPTER 1

INTRODUCTION

1.1. Background and Problem Statement

The agricultural sector contributes significantly to the development of the economy of Ghana. In the year 2001 for example, it contributed 35.9 percent of the total Gross Domestic Product (GDP) of the economy. In the same year, it also contributed 33.3 percent of the total foreign exchange earnings of the economy of Ghana and employed 55 percent of the population (ISSER, 2002). Its contribution to GDP increased to 39.5percent in 2002; it still remains the highest contributor, considering all the major sectors (ISSER, 2003), and the largest employer of Ghana's active population. It currently contributes 35.5 percent of total foreign revenue (ISSER, 2003).

Cocoa has traditionally been very important to Ghana. It has been a major export commodity and a source of income. For example, in 1997, about 14.7 percent of the total tax revenue of the country was obtained from cocoa (GSS, 1998). In the same year, cocoa accounted for about 28.1 percent of total foreign revenue earned by Ghana. Cocoa also contributed 20.5 percent of total foreign exchange in the year 2001 (ISSER, 2002). To date, cocoa remains the leading agricultural export commodity; contributing 30.2 percent of the total foreign exchange while total agricultural exports constitutes 42 percent of total foreign revenue. Furthermore, cocoa constitutes 66.67 percent of foreign revenue generated

from agricultural exports (ISSER, 2003). Notably, cocoa contributed 4.6 percent of the total tax revenue in 2001, constituting an amount of ¢300billion. Furthermore, most of the agricultural sector's contribution to government's tax revenue is generated from levies on cocoa exports and local cocoa duty. Thus, cocoa cultivation constitutes the leading economic activity in the agricultural sector.

To the economy of Ghana, cocoa serves as a major source of employment in the agricultural sector. A majority of farmers as well as those engaged in the handling of the crop for exports obtain their livelihood from cocoa such that 24 percent of the labour force is associated with cocoa (ISSER, 2003).

Diversification, which is the process of spreading an investment across assets and thereby forming a portfolio, is an important phenomenon for investments of all kinds (Ross, Westerfield and Jordan, 1998). A producer is said to be diversifying if he or she cultivates other crops in addition to cocoa or raises animals mainly for the purpose of income generation. A cocoa farmer who also undertakes off-farm activities for income generation is also considered to be diversifying. Diversification could be horizontal or vertical. Horizontal diversification is where there is production of a variety of crops or livestock or a combination of both. Vertical diversification is where there is a combination of production, marketing and processing activities. Diversification is especially important in the reduction of risk from a portfolio by eliminating unsystematic risk.

Agricultural diversification creates opportunities for achieving higher and more stable rural incomes through the more efficient use of resources and the exploitation of comparative advantage (Barghouti, Garbus and Umali, 1992). Diversification is also a strategy to promote agricultural development through

reducing production and price risks, increasing income and sustaining economic growth (Petit and Barghouti, 1992). The agricultural sector of Ghana is faced with so much risk and uncertainty as most crop production in Ghana is rain-fed and the cocoa sector is no exception to this risk exposure. As a result, production levels tend to depend substantially on climatic conditions, inter alia. Therefore, an unfavourable climatic change is likely to disrupt production and consequently cause income fluctuations.

Alternative ways of dealing with the impact of risk on agriculture has captured the attention of economists and policy makers for a long time (see for instance Quiroz and Valdés, 1995). Many countries have initiated policy reforms aimed at liberalising domestic markets, removing quota restrictions on trade, and opening up their economies to international trade opportunities. However, this process has the potential of causing price variability as a result of world market fluctuations, thus causing producer price variability (Hazell, Jaramillo and Williamson, 1990; Schiff and Valdés, 1992). According to Quiroz and Valdés, (1995), the phenomenon of diversification of the production mix can be an efficient means of minimising the impact of risk on producers' welfare. Thus, it has the potential of stabilizing producer commodity prices and can therefore stabilise the incomes of cocoa producers in Ghana in general and in the Ashanti Region in particular.

Cocoa producers in Ghana have been noted to be spendthrifts during cocoa harvesting seasons only to become financially constrained in the lean seasons. This compels them to borrow from informal sources such as moneylenders with high interests rate, and later on causing high levels of indebtedness (Nyanteng,

1980). In addition, some cocoa producers pledge their farms as guarantees for loans, which they need and consequently display little interest in the maintenance of the farm with the unfortunate understanding that the creditors will take over the farm if they are not able to repay the loan (Nyanteng, 1980). Yet other producers release their farms as mortgages against debt funds. Diversification into other short-term and regular income-generating crops and livestock as well as off-farm activities could help cocoa producers generate regular income to prevent them from borrowing from informal credit sources at exorbitant interest rates and consequently using their farms as securities and mortgages.

Diversification could generate regular income for cocoa producers for their upkeep and maintenance of their cocoa production activities in order not to shift completely out of cocoa cultivation. The Ashanti Region, being a prime cocoa-producing region and having good soil and climatic conditions for cocoa, has the potential of increasing its cocoa output through diversification. This can be attained through the cultivation of other crops and rearing of animals as well as engaging in off-farm activities to generate income, whilst maintaining cocoa cultivation. Thus, diversification does not indicate an outright shift from cocoa to other crops or livestock.

In summary, diversification reduces risk in production, as the variation in income is reduced and the expected returns increased. Unfortunately, the specific reasons for diversification undertaken by cocoa producers in the Ashanti Region are largely unknown.

The socio-economic factors determining the diversification behaviour of cocoa producers in the Ashanti Region are also largely not known. Furthermore, the

effect of the socio-economic factors on diversification behaviour of the producers in the Ashanti region is not known. The constraints to diversification in the cocoa economy in the Ashanti Region are also largely unknown. What are the reasons why cocoa producers in the region diversify? What are the socio-economic factors determining the diversification behaviour of cocoa producers in the Ashanti Region? How do these factors affect diversification behaviour of cocoa producers in the area? What are the constraints encountered by the producers in diversifying? Owing to differences in soil type, land availability, skills acquisition, availability of capital, interest and other unknown factors, producers diversify into different crops, livestock types and off-farm activities. The specific crops, livestock species and off-farm activities to which producers in the Ashanti Region diversify are largely unknown. These are the issues, which the present study addresses.

1.2. Objectives of the Study

The **primary objective** of the present study is to analyse the factors, which determine the probability that cocoa producers in the Ashanti Region of Ghana diversify or do not diversify.

The **specific objectives** are as follows:

1. To identify the reasons why cocoa producers in the Ashanti Region diversify.
2. To quantify the effects of the socio-economic factors which influence the diversification behaviour of cocoa producers in the Ashanti Region.
3. To identify, describe and rank the constraints to diversification by cocoa producers in the region.

1.3. Relevance of the Study

As already indicated, cocoa is an important commodity in the economy of Ghana. It provides a source of livelihood for a significant portion of the labour force (specifically, 24 percent). It earns substantial foreign exchange for Ghana: 28.1 percent of the total foreign earnings in 2002 were from cocoa exports for example (ISSER, 2003). The contribution of cocoa to total foreign earnings of Ghana is relatively large, comparing to other export crops such that without cocoa exports, there will be a great decline in foreign earnings through export. Issues concerning cocoa have been of great concern to the government of Ghana presently. Thus, a study on cocoa, which will generate policy recommendations that will enhance the overall output of cocoa, will be of importance to policy-makers. Cocoa serves as a major source of wealth.

Some authors have presented diversification in rural households as a means of increasing income levels. (Barghouti, Timmer and Siegel, 1990, De Janvry and Sadoulet, 2001). This process involves the broadening and strengthening of income sources of rural households. They also described this process of diversification as gradual and inevitable since it extends from the introduction of new crops and technologies into traditional farming systems to the development of off-farm jobs in small-scale rural industries. As the rural work force shifts from agriculture to industry or services in order to increase income, it is important to motivate the rural work force in order to remain in agriculture and still engage in off-farm activities. This strategy is important to maintain the agricultural sector and especially the cocoa industry. A study of the theme of diversification is therefore important to guard the cocoa industry from collapsing.

Research on the theme 'diversification' is very important for developing countries that are characterised by a shift in labour from agriculture to service and industry associated with rural to urban migration. Ghana is no exception to this characteristic feature. However, there has been scanty rigorous research on the theme of the present study in Ghana. The present study will therefore contribute to the body of knowledge on diversification in Ghana.

The Ashanti Region, which is the study area, possesses good climatic conditions for cocoa cultivation (see section 3.5). It has the second largest number of cocoa producers in Ghana (88,800 producers) and it is the second highest contributor to the total output of cocoa in Ghana (GOG, 1998). Furthermore, the region has a great potential for increasing its cocoa output. This goes to justify the choice of the study area.

1.4. Organisation of the Study

The study entails five chapters. Chapter 2 reviews the relevant literature concerning diversification; its definitions and meaning as well as its determinants. The Chapter also includes information on relevant empirical literature on diversification as well as measures of diversification. Chapter 3 covers the methodology employed. In Chapter 4, the empirical results are presented. Chapter 5 presents a summary of the major results of the study, followed by policy recommendations based on the findings of the study. It also contains suggestions for future research based on the limitations of the study.

CHAPTER 2

LITERATURE REVIEW

Although there has been scanty rigorous research on the theme of diversification in Ghana, there are publications of studies on the theme by authors elsewhere. It therefore pays to review relevant literature on diversification to obtain enough information for guidance. Various authors have viewed the concept of diversification differently. This Chapter reviews literature on the various views of the concept of diversification and then gives the view of the concept of diversification with respect to the present study. It also reviews literature on the various forms of diversification spelt out by various authors. Literature on the measures of diversification as well as the determinants is reviewed. Finally, literature on empirical econometric issues concerning diversification is reviewed in this Chapter.

2.1. The Concept of Diversification

Diversification, from the point of view of finance, is defined as the process of spreading an investment across assets, and thereby forming a portfolio (Ross, Westerfield and Jordan, 1998). Branch, Maher and Zacharias (1988), employed Theil's Diversity Index, which is based on the concept of entropy. Minimum diversity is the practice of a single system over the universe, and maximum diversity is an equal distribution of all enterprises. Diversification is minimum when there is a single enterprise and it is said to be maximum when there are equal distributions of all

enterprises. Thus the intensity of diversification is based on the number of enterprises a farmer or investor undertakes.

Diversification among rural households has been termed as rural diversification by some authors. Barghouti, Timmer and Siegel (1990) defined rural diversification as the process of broadening and strengthening the income sources of rural households. This process extends from the introduction of new crops and technologies into traditional farming systems to the development of off-farm jobs in small-scale rural industries. Rural diversification arises when there is deterioration of farm incomes because of sudden and sharp declines in earnings from specific crops or because incomes in farming rapidly decline relative to incomes in other sectors.

Diversification behaviour of cocoa producers is purposely for income generation. Hence diversification could be explained in the light of income diversification. In diversification, resources are invested in all possible forms of agricultural and non-agricultural activities from which one can generate income. Diversification in the context of this study refers to the situation whereby a cocoa producer adds other crops and/or livestock or off-farm economic activities to cocoa production for the purpose of income generation. A cocoa producer diversifying may cultivate other annual crops such as cassava, plantain, yam, cocoyam, pepper and so on, in addition to cocoa for the purpose of generating income from these crops. This same producer may engage in livestock rearing and/or off-farm activities such as trading, teaching, gari processing, palm oil extraction, mining, and palm-wine tapping, and so on for income. A non-diversifying cocoa producer cultivates only cocoa and no other crop, or livestock or off-farm activity for income. Again, a cocoa producer

undertaking an off-farm activity in addition to cocoa cultivation is considered as diversifying.

2.2. Forms of Diversification

Generally literature concerning diversification categorise diversification as income diversification, farm diversification or agricultural diversification, rural diversification, crop diversification or pastoral diversification. These forms of diversification have a common interest in increasing income.

Income diversification refers to the allocation of production assets among different income-generating activities, both on-farm and off-farm (Abdulai and CroleRees, 2001). Income diversification serves as a risk management strategy and is usually taken to imply a trade-off between a higher total income involving greater probability of income failure, and a lower total income involving smaller probability of income failure (Ellis, 2000). Thus, risk-averse households are willing to accept lower income for greater security. Income diversification is therefore linked to lowering risk. Income diversification can play a key role in stabilising incomes and alleviating rural poverty.

Farm diversification refers to the integration of crops, livestock and fisheries (Chainuvati and Athipanan, undated). An addition of livestock to crops is an indication of wealth in some social settings. Rural households in Sub-Saharan Africa generally consider holding livestock as an important means to further wealth (Reardon, Delgado, and Matlon 1992). This is because households are able to use livestock as collateral for loans to start non-farm enterprises and thus increase their

income earning status. Secondly, revenue from animals and by-products sold can be included in non-crop income.

Rural diversification is defined by Barghout et al, 1990 as the process of broadening and strengthening the income sources of rural households. This process extends from the introduction of new crops and technologies into traditional farming systems to the development of off-farm activities in small-scale rural industries. In between these two extremes could be the introduction of livestock farming for instance to crop farming. These additions and developments are gradual and crop farmers find them necessary to increase their income.

Matlon (1991) explained crop diversification as cropping different enterprises across dispersed plot areas as well as through the planting of crops in mixtures on the same plot. Crop diversification has also been categorised into horizontal diversification and vertical diversification (Bin Tunku Yahya, undated). Horizontal diversification is the cultivation of an increasing number of crops as opposed to one or two major crops. In horizontal diversification, farmers rely on different crop phenotypes (long/short varieties) to diversify risks within a single activity. Vertical diversification, on the other hand, refers to the upstream and downstream activities of a particular crop or crops. It starts from primary production viz., farm products and goes through primary and secondary processing and finally to finished products. Thus, vertical crop diversification involves off-farm processing of crops into finished products such as fruit juice, gari, and canned foods.

Little (undated), in a study on pastoral diversification in East Africa, defined pastoral diversification as the pursuit of non-pastoral income-earning activities in addition to pastoral activities, whether in rural or urban areas. This

involves various forms of trade, wage employment, farming, as well as gathering and felling of trees from the wild. It also involves the renting of property and ownership of income producing assets such as vehicles.

2.3. Measures of Diversification

Pope and Prescott (1980) measured diversification in terms of net income and crop acreage. They proposed four measures of diversification in agreement with, and as an upgrading of the measures proposed by other researchers such as Berry (1971), White and Irwin (1972) and Hackbart and Anderson (1978). The four measures are M_1, M_2, M_3 and M_4. Each of these measured were defined either in terms of income or acreage. M_1 is defined as the index of maximum proportion of income from a particular crop or enterprise. When defined in terms of acreage it indicates the index of maximum proportion of land allocated to a particular crop or enterprise. M_2, is also defined as the sum of the number of enterprises whilst M_3 is defined as the sum of squares of the proportions of income from each enterprise or sum of squares of the proportion of land allocated to each enterprise. This measure is also referred to as the Herfindahl index. M_4, which is also known as the entropy index is defined as a multiple of the proportion of income earned from each enterprise and the logarithm of the inverse of the proportion of income earned from each enterprise. Each of these four measures has different causality with diversification. As diversification increases M_1 and M_3 generally decrease while M_2 and M_3 generally decrease.

Land utilisation has been the unit of diversification when dealing with crop diversification (Zandstra, 1992). However, this naturally becomes less attractive when the enterprise set includes aquaculture, forestry, or on-farm processing or crop-animal

systems. It seriously becomes less attractive when dealing with off-farm activities such as teaching, trading and driving. In such cases other resource allocations such as time allocation or their aggregate could be used.

2.4. Determinants of Diversification

Determinants of diversification are the factors, which in one way or the other can be considered by an individual concerning the decision to diversify. Generally, these factors are either characteristics of the environment or attributes of the decision-maker. Abdulai and CroleRees (2001) noted that the decision of a household concerning income diversification depends upon both household characteristics and location-specific characteristics. Abdulai and Delgado (1999) observed the determinants of nonfarm earnings of farm-based husbands and wives in Northern Ghana to be either personal or locational characteristics of the individuals under study. Similarly, De Janvry and Sadoulet (2001) also explained that individual, household and locational characteristics all play a role in explaining participation in off-farm activities among rural households in Mexico. Thus, it can be said that individual, household and locational characteristics influence diversification.

The individual characteristics constitute the personal attributes of the person that enables him to diversify or prevent him from diversifying. Individual characteristics such as level of education, number of years of formal education, age of individual, ethnicity of individual and level of experience in farming, level of wealth, farm size and gender can either enhance or prevent diversification. The household characteristics comprise the level of resource endowment and responsibility in terms of financial requirements on the household. Determinants could also be identified to

be challenges, opportunities, prospects and constraints as far as the productivity and livelihood of the decision-maker are concerned. As stated by Alderman and Paxson (1992), diversification of income sources is one of the strategies households employ to minimise household income variability. A household head with a high level of family responsibility is therefore likely to engage more in income diversification in order to minimise household income variability.

Abdulai and CroleRees (2001) identified individual characteristics such as age, level of education and land holding of household head as possible determinants of income diversification. Abdulai and Delgado (1999) noted that educational level and experience in farming as some of the factors which enabled farm-based husbands and wives in Northern Ghana to engage in non-farm income activities. Pope and Prescott (1980) identified experience of farmer and age of farmer as individual characteristics and socio-economic determinants of diversification of crop farmers in California.

The number of years of formal education and age of the decision-maker has been found to play a major role in stimulating increased levels of off-farm income activities among rural households in Mexico (De Janvry and Sadoulet, 2001). Furthermore, adults with many years of education tend to have better access to off-farm non-agricultural employment than adults of lesser years of education. Among spouses of household heads, those who had access to non-agricultural wage employment have 11.6 more years of formal education. Thus wives with higher levels of formal education gained better access to non-agricultural wage than wives of lower levels of formal education.

Younger adults had better access to wage employment than older women. They also observed the age of household head and age of spouse to be determinants of participation in off-farm activities; ethnicity was also found to be an important determinant of diversification (De Janvry and Sadoulet, 2001). Indigenous households had less access to off-farm wage employment while non-indigenous households had greater access. This is due to the fact that the non-indigenous were more educated than the indigenous.

Pope and Prescott (1980) pointed out that farm size is one important determinant of diversification by farmers in California. Net worth (wealth level) is also one of the determinants of diversification, as it depicts the motive behind a farmer's attitude of diversifying (Pope and Prescott 1980, Little, undated). Wealthier farmers tend to engage in diversification activities to promote economic growth through accumulation of assets while the poor diversify for survival and food-security purposes (Little undated). Thus, the wealthier farmers engage in lucrative trading professions whereas the poor are relegated to marginal activities such as sale of fuel wood or charcoal production.

Gender has been identified as a very important socio-economic determinant of diversification among rural households (Little undated and De Janvry and Sadoulet 2001). Gender affects the types of off-farm activities to which farmers diversify. Women tend to engage in sale of agricultural produce, alcohol brewing, and other forms of petty trading, while men tend to engage in wage employment.

Concerning household characteristics, Abdulai and CroleRees (2001) observed that the number of adult males, the number of adult females and the number of children in a household as well as the household size are possible determinants of

income diversification. Larger household sizes tend to have larger number of dependants and this has a likelihood of increasing the financial responsibility of the household head, who will naturally seek to increase his income level to cater for the increasing household size. Pope and Prescott (1980) observed that form of ownership of land, whether it is family, individual or corporate ownership are other socio-economic determinants of diversification of crop farmers in California. De Janvry and Sadoulet (2001) indicated again that the household's access to land affects its participation in off-farm activities whereby greater access to land reduced participation in construction work, which is an easy-entry low-paying activity.

Location-specific characteristics are also important in the decision of a household or farmer to diversify. They affect the general behaviour of farmers in a locality towards diversification. For instance, the types of infrastructure available may determine the types of off-farm activities to which a farmer will diversify (Abdulai and CroleRees, 2001). The nature of the vegetation will also determine the types of crops and livestock species to which a cocoa farmer for instance can diversify. Climatic factors are very important location-specific determinants of diversification (Abdulai and CroleRees 2001). Somel (1992) identified location-specific determinants such as access to marketing, access to infrastructure, availability of research and extension and access to social services as influential in a farmer's decision concerning agricultural diversification.

Barghouti, Timmer and Siegel (1990) realised that marketing and infrastructure are related determinants of diversification. Lack of infrastructure such as good roads and telephone lines can impede the development of markets. With poor road networks undependable or irregular means of communication, local and regional

markets remain isolated from each other and also retard the flow of information about surpluses and scarcities in the market. Some other location-specific determinants are distance to capital town, distance to the nearest market and access to infrastructure (Abdulai and Delgado 1999, Abdulai and CroleRees 2001, Little undated). Closeness to capital town and market centres enhances involvement in non-agricultural off-farm activities, which are normally located in the cities. Farmers closer to market centres have a higher likelihood of participating in trading activities.

Population density is yet another location-specific determinant which has been found out to exert an effect on the decision of households to participate in off-farm activities (Abdulai and Delgado 1999, De Janvry and Sadoulet 2001). With high population density, opportunities for trading and other vocational activities arise as the market segment is enlarged.

Petit and Barghouti (1992) documented that crop diversification at the farm level is determined by changes in world markets where many farmers make adjustments to their cropping patterns to the extent permitted by technological and market considerations. They added that crop diversification is affected by on-farm constraints such as the availability of extension services, the opportunities for contract farming and mechanisms for organising farmers, and the responsiveness of farmers to the various signals they receive. In addition, they identified certain factors which influence diversification at all levels, namely, farm, regional, sectoral and intersectoral levels. These factors include government policies, agricultural input supply, and institutional support.

Government macroeconomic and agricultural (concerning prices) policies may either promote or impede diversification. It is noteworthy that although these

policies may be designed to stimulate agricultural diversification, they may conflict with the pursuits of other priorities, such as maintaining the stability of food prices and food security. Government's supply of inputs for all crops enhances crop diversification since most farmers would decide to benefit from such supplies. Therefore when a particular government is providing inputs to farmers in all types of crop enterprises farmers will decide to cultivate as many types of crops so as to benefit fully from the government's provision which may either be subsidised or without cost. Support from various institutions such as research and extension, marketing, adult education, non-governmental organisations will enhance diversification.

Low market demand for staples produced, high production and market risks, high labour supply and broad adaptation of crops and management techniques tend to lead to diversification (Zandstra 1992). Low market demand for staples produced tend to cause vertical diversification as the producer diversifies to processing activities of the staples produced.

2.5. Empirical Econometric Literature on Determinants of Diversification

Abdulai and Delgado (1999), employing a bivariate Probit analysis to explain the probability of participating in non-farm work, came out with the directions of the effects of the determinants of diversification behaviour of farmers. The log-likelihood ratio statistic was significant at the one percent level, an indication that the independent variables taken together influenced participation decisions. The results suggested that at younger ages, an increase in age increased the probability of participation in non-farm activities with the maximum effect occurring at just over

thirty-three years for husbands and at thirty years for wives. At older ages, the probability of participating in non-farm work decreases as age increases.

They also recorded that a husband or wife who had more schooling had a significantly higher probability of engaging in non-farm activities. The marginal effect of a year of female schooling on the probability of participation in non-farm activities (0.51) was greater than that of male schooling (0.30). Thus in their study, additional schooling of the male did not significantly influence the participation in non-farm activities as it did for females. They again identified well-developed infrastructure and population density as exerting positive significant effects on the probability of non-farm work. Infrastructure exerted the highest marginal effect (0.690 for males and 0.78 for females) among the explanatory variables.

Pope and Prescott (1980), using ordinary least squares identified that farm size had a positive effect on diversification. Net worth, which is an indication of wealth, also had a negative significant effect on diversification. This implied that wealthier farmers diversified the least, *ceteris paribus*. Abdulai and CroleRees (2001), employing the Logit model, noted otherwise, that the wealth of a household represented by its land holding exerted a positive and significant impact on the likelihood of diversification. These two conflicting findings were made from studies made in two different geographical settings. Farmers in California as highlighted by Pope and Prescott (1980) specialised the more as they become wealthier. Technological advancement could be a reason for specialisation with an increase in wealth since farmers can benefit from economies of scale with the use of certain machinery. Secondly as these farmers become wealthy, it is likely to afford the use of advanced technology and rather specialise. Their results are consistent with risk

theories, which indicate that "the firm diversifies to spread risk and wealthier farmers have fewer incentives to spread risk".

On the other hand farmers in Southern Mali, as studied by Abdulai and CroleRees (2001), may not depend so much on technology in farming perhaps due to the fact that they are not accustomed to advanced technology. Thus the only way of managing risk is to invest in a variety of activities.

Age of farmer and farming experience exerted positive significant effects on diversification. The explanation was that young farmers start on a small scale and specialise and perhaps become more diversified as they expand their operations and also gain experience with time (Pope and Prescott (1980).

Access to extra land also had a significant marginal effect on diversification. Multiplicative interactions between the determinants revealed that wealthy households who live closer to markets were more likely to participate in diversification activities than their counterparts in remote areas. This suggests that satisfying any one of the determinants alone is not enough justification for diversification. This finding supports the notion that farmers with superior access to markets are in a better position to overcome factor market constraints and develop private marketing initiatives that make diversification more attractive.

Variables representing demographic effects such as number of children, number of adult females and household size were not significant. However, for farmers in livestock production, the parameter estimate on the number of adult males was significant. At higher levels of family labour, extra male effort is directed into livestock rearing. Age was also significant since a discernible age pattern was observed in participating in diversification activities. The results further revealed that

the likelihood of participation first rose with age and peaked off at 41 years and then declined.

In addition, they found out that the coefficient of food price variability was positive and significant. This indicated that the probability of participating in diversification activities increased with increasing volatility in food prices. Therefore, government policies, which precipitate higher levels of food price variability, are likely to exert a positive significant effect on diversification activities. The multiplicative interaction term between land holding and education was positive and significant. This implied, inter alia, that more educated households are more likely to diversify than less educated counterparts. Education seemed to have been a significant factor contributing to the greater ability of wealthy families to diversify, given that poverty is closely associated with low levels of education and skills (Ellis, 2000).

De Janvry and Sadoulet (2001) observed that location plays a role in farmers' participation in off-farm activities. The density of urban centres to which an individual had access increased female participation in non-agricultural wage labour and decreased their participation in the agricultural labour market. They also found out that age exerted a positive effect on participation in off-farm activities for men but rather exerted a negative effect on women. This could be explained by the fact that older women had more domestic responsibilities than younger women and this reduced their participation in diversified activities.

Ethnicity, which was defined as speaking an indigenous language, also had a negative effect on participation in off-farm activities (De Janvry and Sadoulet, 2001). Surprisingly, indigenous populations were living in poverty as a result of disfavour in accessing the more remunerative off-farm activities.

CHAPTER 3

METHODOLOGY

This Chapter outlines the sampling technique employed in the data collection and the method of analysis employed. Initially, a theoretical framework of the concept under study is developed in order to identify the best empirical model used in analysing the data. This is important to justify the use of the empirical model. This Chapter states the hypotheses validated in the analysis and also clearly specifies the empirical model employed for the study. Finally, the variables employed in the econometric analysis are described in the chapter. The Chapter also includes information on the sources of data and the data collection procedures.

3.1. Producers' Reasons for Diversification

Questionnaires were administered to the producers interviewed in the study in order to identify the reasons why they diversify into the various income-generating activities in which they are engaged. With the questionnaires, the following information was obtained from the producers: First, the reasons why the cocoa producers in the Region diversify and what they consider as the constraints to diversification. Then the cocoa poducers' ranking of the reasons for diversifying as well as their ranking of the constraints to diversification in order of importance is also obtained from through questionnaire. After the cocoa producers have ranked the various reasons for diversifying, the concordance or agreement among the rankings by the producers is statistically validated using Kendall's Concordance Coefficient and

the overall rankings of the reasons are obtained from the sum of ranks, given that there is concordance (Kendall, 1948).

By definition, Kendall's Concordance Coefficient (W) is given by

$$W = (12S) / m^2 (n^3-n) \quad (1)$$

where m denotes the sample size, n denotes the number of reasons or constraints for diversification and S is given by

$$S = \sum (R_i-R_M)^2 , i = 1, 2, ...N \quad (2)$$

where R_i denotes number of ranks, R_M is the mean of ranks given by

$$R_M = \sum R_i / n \quad , i= 1,2.... N \quad (3)$$

The significance of Kendall's Concordance Coefficient (W) is validated by testing the following null hypothesis:

H_0 : Kendall's Concordance Coefficient (W) is not significantly different from zero, versus

H_1 : Kendall's Concordance Coefficient (W) is significantly different from zero.

The relevant Z- statistic here is given by

$$Z = 1/2\log_e(m-1)/(1-w) \quad (4)$$

where "e" denotes the base of the natural logarithm. V_1 and V_2, the relevant degrees of freedom are given by (5) and (6) as follows:

$$V_1 = n-1-2/m \quad (5)$$

$$V_2 = (m-1)\, V1 \quad (6)$$

The decision criteria is that if $Z > Z^*_{(v1, v2), \alpha}$, then, H_0 is rejected in favour of H_1, but if $Z \leq Z^*_{(v1, v2), \alpha}$ then H_0 is not rejected. Here, α is the level of significance and Z* is the critical value of the Z–statistic from the Fisher's table. If H_0 is

rejected, then it implies that there is concordance among the ranks. Thus, the sum of ranks can be used to obtain the overall rank of each of the reasons for diversification. The reason with the smallest sum of rank is taken to be the most important reason and is given a rank of 1 and in ascending order of the sum of ranks; the next important reason is given a rank of 2, following in that order.

3.2. Theoretical Framework

A binary choice model, which models the choice behaviour of individuals when two alternatives are available and one must be chosen, is the most appropriate for a study such as the present one on diversification, where a cocoa producer has to choose between diversifying and not diversifying. This binary choice of the i th individual is conveniently represented by a random variable y_i which takes a value of 1 when one choice is made and 0 if the other choice made (Jugde, Hill, Griffiths, Lutkepohl and Lee, 1982). If P_i is the probability that y_i takes the value 1, then $1-P_i$ is the probability that y_i is 0. The probability function for y_i is given as:

$$F(y_i) = P_i^{yi}(1-P_i)^{1-yi} \qquad (7)$$

In examining the factors which affect the probability (P_i) of diversifying, an assumption is made that the average utility derived from the choice by an individual is based on the attributes of the choice, which are specific to the individual; for example, the individual's socio-economic characteristics. Thus, the utility derived from the choices of the individual is defined as the average utility plus a random disturbance.

$$U_{i0} = \bar{U}_{i0} + e_{i0} = \mathbf{z}'_{i0}\boldsymbol{\delta} + \mathbf{w}'_i\boldsymbol{\gamma}_o + e_{i0} \qquad (8)$$

$$U_{i1} = \bar{U}_{i1} + e_{i0} = \mathbf{z}'_{i1}\boldsymbol{\delta} + \mathbf{w}'_i\boldsymbol{\gamma}_1 + e_{i1} \qquad (9)$$

where U_{i0} and U_{i1} are the utilities from the two choices of not diversifying and diversifying respectively. $\bar{U}_{i0}$ and $\bar{U}_{i1}$ are the average utilities and $\mathbf{z}'_{i0}$ and $\mathbf{z}'_{i1}$ are vectors of characteristics of the alternatives, as perceived by individual i, $\mathbf{w}'_i$ is a vector of socio-economic characteristics of the i th cocoa producer and e_{i0} and e_{i1} are random disturbances.

The ith cocoa producer maximises utility subject to the attributes of the choice made and his socio-economic characteristics. He will choose alternative 1 only if $U_{i1} > U_{i0}$ or if the unobservable or latent random variable $y_i^* = U_{i1} - U_{i0} > 0$. The observable random variable y_i is given by

$$y = 1, \text{ if } y_i^* > 0 \text{ and } y = 0, \text{ if } y_i^* \leq 0 \tag{10}$$

y_i^* is rewritten as

$$y_i^* = (\mathbf{z}_{i1} - \mathbf{z}_{i0})'\boldsymbol{\delta} + \mathbf{w}_i'(\gamma_1 - \gamma_0) + (e_{i1} - e_{i0}) \tag{11}$$

$$= [(\mathbf{z}_{i1} - \mathbf{z}_{i0})', \mathbf{w}_i]\ \underset{\boldsymbol{\delta}}{[\gamma_1 - \gamma_0]} + e_i^*$$

$$= \mathbf{x}'_i\boldsymbol{\beta} + e_i^* \tag{12}$$

where $\mathbf{x}'_i$, $\boldsymbol{\beta}$ and e_i^* are explanatory variables, unknown location parameters and random errors in the linear statistical model for y_i^*. The probability that $y_i = 1$ is given by (13):

$$P_i = \Pr[y_i = 1] = \Pr[y_i^* > 0] = \Pr[e_i^* > -\mathbf{x}'_i\boldsymbol{\beta}] \tag{13}$$

To make the model complete, a particular probability distribution for e_i^* must be chosen. The choice of the logistic leads to the logit model. Mathematical tractability and cheaper cost suggests the use of the logistic distribution in the present study. The logistic random variable is

$$F(t) = 1/[1+\exp(-t)] \tag{14}$$

Since the logistic distribution is symmetrical, equation (13) can be written as (15):

$P_i = Pr\ [e_i^* >- \mathbf{x'}_i\ \boldsymbol{\beta}]$

$= 1 - Pr\ [e_i^* \leq - \mathbf{x'}_i\ \boldsymbol{\beta}] = 1 - F\ (- \mathbf{x'}_i\ \boldsymbol{\beta})$

$= \mathbf{F(\ x'_i\ \beta)}$ (15)

The probability that a cocoa producer will diversify is therefore a function of the socio-economic characteristics.

3.3 Statement of Hypotheses

The following hypotheses are validated in the present study. H_O denotes null hypothesis wheras H_1 denotes alternative hypothesis.

I. H_O : Age of the cocoa producer exerts no effect on the diversification behaviour cocoa producers, versus

H_1 : Age of the cocoa producer exerts a positive effect on diversification behaviour of cocoa producers.

II. H_O : Gender of the cocoa producer exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Gender of the cocoa producer exerts a positive effect on diversification behaviour of cocoa producers.

III. H_O : Experience of the cocoa producer (number of years in farming) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Experience of the cocoa producer exerts a positive effect on diversification behaviour of the cocoa producers.

IV. H_O : Level of education of the cocoa producer exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Level of education of the cocoa producer exerts a positive effect on diversification behaviour of the cocoa producer.

V. H_O : Number of dependants of cocoa producer exert no effect on diversification behaviour of cocoa producers, versus

H_1 : Number of dependants of cocoa producer exert a positive effect on diversification behaviour of cocoa producers .

VI. H_O : Farm size exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Farm size exerts a positive effect on diversification behaviour of cocoa producers.

VII. H_O : Access to extension services exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to extension services exerts a positive effect on diversification behaviour of cocoa producers.

VIII. H_O : Access to infrastructure (primary school) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to infrastructure (primary school) exerts a positive effect on diversification behaviour of cocoa producers.

IX. H_O : Access to infrastructure (secondary school) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to infrastructure (secondary school) exerts a positive effect on diversification behaviour of cocoa producers.

X. H_O : Access to infrastructure (Postal services) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to infrastructure (Postal services) exerts a positive effect on diversification behaviour of cocoa producers.

XI. H_O : Access to infrastructure (Health services) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to infrastructure (Health services) exerts a positive effect on diversification behaviour of cocoa producers.

XII. H_O : Access to infrastructure (telephone facilities) exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to infrastructure (telephone facilities) exerts a positive effect on diversification behaviour of cocoa producers.

XIII. H_O : Access to extension services exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to extension services exerts a positive effect on diversification behaviour of cocoa producers.

XIV. H_0 : Access to loan exerts no effect on diversification behaviour of cocoa producers, versus

H_1 : Access to loan exerts a positive effect on diversification behaviour of cocoa producers.

3.4. Empirical Model

The logit model, a binary choice model, is employed in this study. The binomial logit model is designed to analyse the choice between two alternatives. As already indicated, in this study, the two alternatives are the choices of a cocoa farmer diversifying or not diversifying. A cocoa producer is said to be diversifying if he

undertakes any income activity, be it crops, animal rearing or off-farm activity in addition to cocoa cultivation.

Let N be the total number of producers and M the number of explanatory variables (specifically, the socio-economic determinants of diversification behaviour). Let X_{ij} be the j th variable (j = 1,2,3,4,.....M) for the i th observation. The model is specified as (16):

$$P_i = F(Z_i) = F(\alpha + \sum \beta_i X_i) = 1/(1+ e^{-Zi}) = 1/1+ e^{-(\alpha + \Sigma \beta Xi)} \quad (16)$$

e represents the base of natural logarithms, which is approximately equal to 2.718. P_i is the probability that a cocoa producer will diversify. Multiplying both sides of equation (16) by $1+ e^{-Zi}$, dividing by Pi and subtracting 1, and taking natural logs of both sides, gives equation (17) thus,

$$Log_e (Pi/1-Pi) = \alpha + \sum \beta_j X_{ij} + U_i \quad (17)$$

where U_i is an error term.

Thus, P_i is the probability of diversification and $(1-P_i)$ is the probability of not diversifying. Pi/ (1-Pi) is the odds ratio in favour of diversification. This is the ratio of the probability that a cocoa producer will diversify to the probability that he will not diversify. X_j is the level of the jth socio-economic determinant of diversification behaviour.

The maximum likelihood estimator is used in estimating the parameters of equation (17). Maximum likelihood estimators are consistent and asymptotically efficient since it has a smaller asymptotic variance (Pindyck and Rubinfeld, 1991).

3.5. Description of Variables and Sources of Data

The probability of diversifying or not diversifying depends on the independent variables, which are the potential socio-economic determinants of diversification. The independent variables employed in the present study are as follows: Age of cocoa producer, gender of cocoa producer, highest level of education of cocoa producer, experience in farming (number of years in farming), distance from residence to farm, farm size, household size (indicated by number of dependents), form of landownership, age of cocoa trees, access to extension services, social status, ethnicity, access to loan, saving at a bank, access to infrastructure, specifically, primary school, secondary school, day care centre, postal services, health facilities and telecommunication facilities.

The independent variables are as follows:

X_1 = Age of cocoa producer (measured in years)

X_2 = Gender of cocoa producer (X_2 = 1 if male and 0 otherwise).

X_3 = Highest level of education of cocoa producer (number of years of formal education.

X_4 = Experience (measured as number of years in crop cultivation).

X_5 = Distance from residence to farm (kilometres).

X_6 = Farm size (acres).

X_7 = Household size (number of dependents).

X_8 = Form of ownership of land (Is land owned by farmer?) = 1 if yes, else =0

X_9 = Age of cocoa trees (measured in years).

X_{10} =Access to extension services = 1 if yes, else = 0.

X_{11} = Social Status =1 if opinion leader, else = 0.

X_{12} = Ethnicity =1 if Asante, else = 0.

X_{13} = Access to loan =1 if yes, else =0.

X_{14} = Saving at a bank (whether or not producer saves at a bank) =1 if yes, else= 0.

X_{15} = Access to infrastructure (schools, health services, postal services and telecommunication facilities).

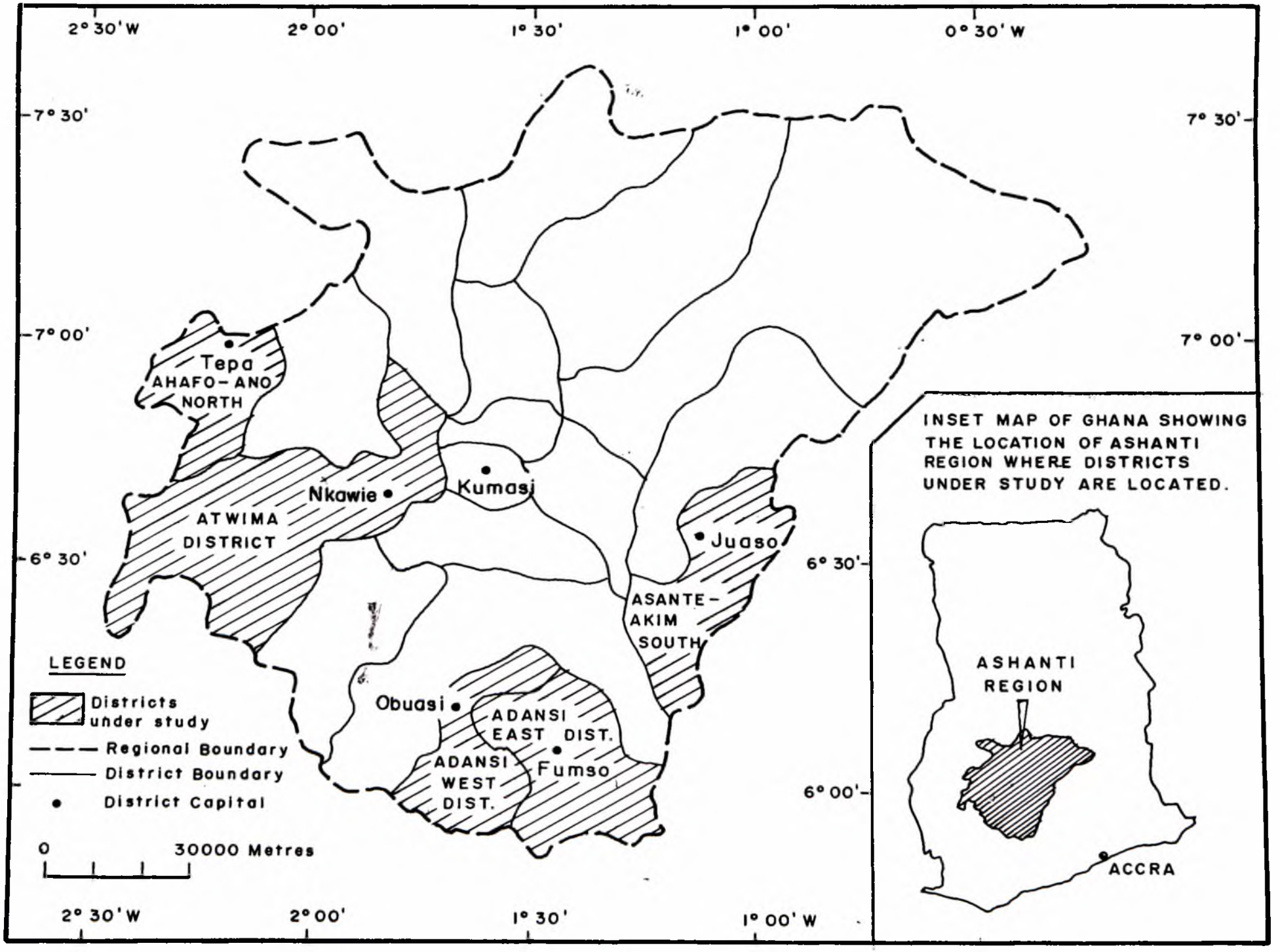
Primary cross-sectional data are obtained from 304 cocoa farmers in the cocoa growing districts of the Ashanti Region through the use of a questionnaire (see Appendix 1). This large sample size is required to obtain a substantial number of producers within the different categories of diversification. Out of the eight cocoa districts, five districts were sampled with the technique of cluster sampling, which is a form of random sampling. Here the cocoa-growing districts indicate the clusters. The choice of this technique is based on the heterogeneity of elements within a cluster. Best results are obtained for heterogeneous elements. In addition, best results are obtained for large sample sizes when cluster sampling is employed. This study entails the use of a large sample size and thus the sampling technique used is appropriate. Thus, five districts, namely Nkawie, Tepa, Obuasi, Fumso and Juaso were randomly selected from the eight cocoa-growing districts in the Ashanti Region.

Sixty respondents were randomly selected from all the districts expect for Fumso where sixty-two respondents were selected to make up the required sample size. (A map of the Ashanti Region, indicating the cocoa growing districts sampled is presented in Figure 1). Recent statistics on population of cocoa producers indicate that the Ashanti Region records the second highest population of cocoa producers in Ghana, following the Western Region. The region, which records a population of

88,800 farmers, is located between latitudes 06.^{0} 07′ N and 07. ^{0} 00′ N and longitudes 01. ^{0} 07 ′ W and 01. ^{0} 48 ′ W. The soils of the Ashanti Region are generally forest ochrosols with some towns such as Tepa having rubrisol ochrosol intergrades (Dickson and Benneh, 1990). The soils are composed of fine-grained granite rocks and as a result give rise to loamy-clayey soils, which are able to conserve moisture throughout the dry season.

The Ashanti Region experiences double maxima of rainfall regime. The first season occurs from May to early July, with the highest in June. The minor rainy season occurs from Septembers to the end of October. The major dry period occurs between December and February while the minor dry period occurs from mid-July to the end of August. The mean annual rainfall value for the year 2002 for Nkawie was 122.600mm while that of Obuasi and Juaso were 124.590mm and 118.350mm respectively. Fumso recorded the highest value of 136.917mm and Tepa recorded the lowest value of 100.025mm (Meteorological Services Dept., 2002).

UNDER STUDY



Source: Kumasi Metropolitan Assembly.

CHAPTER 4

EMPIRICAL RESULTS

This Chapter presents the empirical results of the present study and describes the reasons why cocoa producers in the Ashanti Region diversify. Specifically, the reasons why they cultivate other annual crops and perennial crops and also why they rear animals or engage in off-farm activities in addition to cocoa production are investigated. The Chapter also gives statistical estimations of the effects of socio-economic factors which influence diversification. Here, focus is on the quantifications of the marginal effects of the factors on diversification behaviour of cocoa producers in the Ashanti Region of Ghana. Finally, constraints faced by producers in diversifying into other crops, animal rearing and off-farm activities are identified and described as ranked by the producers.

4.1. Reasons for Diversification into Perennial Crop Production

Cocoa producers in the Ashanti Region diversify into perennial crops such as oil palm, citrus and teak. One hundred and fifty-seven out of the three hundred and four producers interviewed in this study were into the production of these perennial crops in addition to cocoa. A majority of the producers (86.6 percent) in perennial crop production were into oil palm cultivation; whilst very few of them (2.8 percent) were in teak cultivation. 11.9 percent of producers in perennial crop cultivation cultivated citrus as the perennial crop in addition to cocoa.

Table 1 presents the reasons for diversification into perennial crops, as ranked by the cocoa producers interviewed. Kendall's Concordance Coefficient is employed here to determine the concordance among the ranks given by the producers.

Table 1. Ranking* of Reasons for Diversification into Perennial Crop Production

Reason	Total Sum Of Ranks	Overall Rank
1. To increase income level	271	1
2. To increase wealth level	339	2
3. To have regular income	357	3
4. To have asset for inter-generational transfer	463	4
5. Soil/land no more suitable for cocoa but suitable for other perennial crops	587	5

* These rankings reflect cocoa producer perceptions.

Source: Author's computations based on primary survey data.

The estimated Kendall's Concordance Coefficient is equal to 0.3027 and the corresponding calculated Z value is 2.057 while the critical value $Z_{4,562}$ is 0.4319 at the 1 percent level. Thus the estimated Kendall's concordance coefficient is significantly different from zero at the 1 percent significant level. Therefore, the sum of ranks here is used to get the overall rank for each of the reasons for diversifying

into perennial crops. The least rank here indicates the most important reason and the largest total sum of ranks indicated the least important reason.

The results indicate that the most important reason for cocoa producers to grow perennial crops in addition to cocoa is to increase their level of income. The next important reason for diversification into perennial crops is to increase the producer's wealth level. Reardon, Matlon and Delgado (1992) similarly observed that diversification in terms of addition of livestock to crop cultivation is a source of wealth such that rural households in Sub-Saharan Africa generally consider holding livestock as an important route to further wealth. The third on the rank of reasons for diversification into perennial crops is to have regular income. Alderman and Paxson (1992), proposed diversification of income sources as one of the strategies households employ to minimise household income variability.

Petit and Barghouti (1992), in concordance with the findings of the present study, also identified the key role income diversification can play in stabilising income and alleviating rural poverty. Rural poverty is directly linked with uncertainties in cash flow patterns of rural households practising rain-fed agriculture. It is noteworthy that the three most important reasons for diversifying into perennial crops are linked with income. As already indicated in the Literature Review in Chapter 2, diversification is mainly aimed at increasing the income level and sources of an individual and most often termed income diversification. It is therefore not surprising to observe that cocoa producers in the Ashanti Region of Ghana engage in perennial crop diversification to increase their income levels. With an increase in cocoa producers' income, they obtain enough financial resources to expand their scale of cocoa production and also invest in other income-generating activities.

4.2. Reasons for Diversification into Annual Crop Production

Cocoa producers in addition, cultivate a variety of annual crops. For annual crops, household consumption is very important, unlike perennial crops for which income increase is the most important. The main additional annual crops cultivated by cocoa producers are cassava, maize, plantain and cocoyam (Appendix II). Some producers also grow vegetables such as tomato, pepper, onion, garden eggs and okro. A few producers cultivate rice and banana for sale. Table 2 presents the rankings of the reasons for diversifying into the aforementioned annual crops. Again, the Kendall's Concordance Coefficient method is employed to test the concordance among the ranked reasons given by the producers. The computed Kendall's Concordance Coefficient is 0.4387 and the corresponding calculated Z value is 2.66 while the critical value $Z_{5,1313}$ is 0.3974 at the 1 percent level. Thus, the null hypothesis of no concordance is hereby rejected. Therefore, the sum of ranks is used to obtain the overall ranks (see Table 2).

The results suggest that the first and most important reason for producers diversifying into annual crops is for household consumption. The main annual crops cultivated are the staples of the producers, namely cassava, maize and plantain (see Appendix II). The producers cultivate the annual crops primarily to feed their families and secondly to sell the rest after the family has had enough for consumption. This is probably one of the food security measures among rural households. The second important reason for diversifying into annual crops is to have additional income and the third important reason is to expand the sources of income. These are probably to reduce the unsystematic risk associated with cocoa, which may arise out of failure in seedling growth, low yield or price variability.

Table 2. Ranking* of Reasons for Diversification into Annual Crop Production

Reason	Total Sum Of Ranks	Overall Rank
1. To have some crops for household consumption	522	1
2. To have additional income	596	2
3. To expand sources of income	750	3
4. To have finances all the time	988	4
5. To maximise the use of land	1072	5
6. Reduction of risk of prices and revenues of cocoa	1391	6

* These rankings reflect the perceptions of the cocoa producers surveyed.

Source: Author's computations based on primary survey data.

The fourth important reason for diversification is to have cash all the time. Cultivating a variety of crops, which are harvested at different times of the year, enables the cocoa producers to gain access to cash all-year round. It is important to note that the important reasons besides cultivating annual crops for household consumption are related to income gain and the nature of income flow. This buttresses the view of Petit and Barghouti (1992) that diversification is a means of increasing income and poverty alleviation in rural households.

4.3. Reasons for Diversification into Animal Production

Cocoa producers in the Ashanti Region are also involved in the production of both large and small ruminants as well as poultry, aquaculture, snails and rabbits (Appendix III). Cattle, sheep, goats, poultry layers, broilers and snails are reared mainly for income and then for consumption. On the other hand, local fowls, ducks and turkeys are reared primarily for consumption and secondarily for income. Rabbit rearing is undertaken primarily as a hobby. Kendall's Concordance Coefficient could not be employed since rankings were not provided for the reasons for diversifying into animal production.

Table 3 indicates the reasons why cocoa producers engage in the production of animals in addition to cocoa cultivation. These cocoa farmers had the opportunity to give multiple responses to the question concerning their reasons for additionally engaging in animal production. Hence, the highest total number of responses for a particular question is taken as the measure of the most important reason. It is clear from the results that the most important reason is to increase the level of income (Table 3). Again this validates the proposal of Petit and Barghouti (1992), that diversification is a means of poverty reduction through income increases in rural households.

The second important reason for diversification into animal production is to expand the sources of income. Cocoa producers would desire to obtain income from diverse agricultural sources in order to spread their risk. Thus, investment in another enterprise such as animal production in addition to cocoa cultivation is likely to reduce the unsystematic risk associated with any of the individual enterprises. Earning

income from diverse sources is also an implication of wealth of a producer, as a farmer earning revenue from various sources is perceived as a wealthy farmer.

The third and least important reason for cocoa producers involving in animal production is to have access to some of the animal produce for household consumption. It can be implied from the results that, to the cocoa farmer in animal production, income gain is of more priority than household consumption. This is contrary to the reasons given by cocoa producers in annual crop production where household consumption is more important.

Table 3. Reasons for Diversification into Animal Production

Reason	Number of Responses	*Percentage of Respondents	Rank
1. To increase income level	161	75.575	1
2. To expand sources of income	147	67.075	2
3. To gain access to animal produce for subsistence consumption	121	56.291	3
4. Rearing animals as a hobby	1	0.003	4

* As a result of multiple responses from respondents, total percentages exceed 100.
Source: Author's computations based on primary survey data.

4.4. Reasons for Diversification into Off-Farm Activities

The producers interviewed during the survey also engaged in off-farm economic activities such as teaching, trading, driving, palm-wine tapping, carpentry and mining (Appendix IV). Other producers worked as civil servants and purchasing clerks in addition to cocoa cultivation. Producers who are civil servants, drivers, teachers, carpenters and miners engaged in these activities as a result of the skills that have been acquired through training or education in the case of civil servants and teachers or apprenticeship as in the case of carpenters. Thus such producers performed their off-farm activities as their primary income-generating activities. Again, rankings were not provided for the reasons producers engaged in off-farm activities. Thus it was impossible to employ the use of Kendall's Concordance Coefficient.

The basic reasons for engaging in these activities, as given by the producers, are presented in Table 4. Due to multiple responses from the producers, the frequencies of the responses are employed to determine the most important reason. From the results, the most important reason for diversifying into off-farm activities is to expand the sources of income. The highest number of responses, namely, 88 producers indicates this. The second reason is also related to income. Cocoa producers diversify into off-farm activities as a result of their low incomes, thus expressing the desire to increase their income through diversification.

The third important reason as indicated by the responses is to have regular flow of income. Producers expressed the desire to have regular income to enable them to meet their needs at all times of the year. Although the season for cocoa harvesting covers a greater portion of the year, there are some intermittent months where there are no cocoa harvesting and revenue from cocoa. Therefore, producers would desire to

engage in either salaried work or regular income activities to obtain income throughout the year and also to increase their level of income. It is clear from the results that the first three important reasons for diversification in this perspective are related to income gain. Producers who also engaged in activities such as teaching, carpentry, driving, gari processing and vocational activities including soap making and batik making did so as a result of some form of training acquired in the areas of the activities. Hence, these producers are engaged in off-farm activities to utilize the skills or training obtained concerning the various activities. Producers in gari processing also do so partly to have some of the products for household consumption.

Table 4. Reasons for Diversification into Off-Farm Activities

Reason	Number of responses	*Percentage of Respondents	Rank
1. To expand the sources of income	88	69.35	1
2. Low income	48	40.08	2
3. To have regular income	23	39.83	3
4. To utilise acquired skill/training	19	31.18	4
5. Household consumption	2	0.65	5

* As a result of multiple responses from respondents, total percentages exceed 100.

Source: Author's computations based on primary survey data.

4.5. Empirical Effects of the Determinants of Diversification Behaviour

Table 5 presents the results of the marginal effects of the determinants of diversification. The McFadden R-squared, being 0.44, indicates that 44 percent of the variations in whether or not cocoa producers in the Ashanti Region diversify are explained by the independent variables. The log-likelihood ratio of 0.011439 is statistically significant at the 5 percent level. This suggests that the independent variables taken together influence cocoa producer diversification decisions. The results further suggest that access to infrastructure such as primary schools, postal services, health facilities and telecommunication services in the community in which a cocoa producer resides are important for diversification (Table 5). Table 6 presents the definitions of the variables used in the logit model and appendices Va to Vd provide the descriptive statistics on the variables used in the Logit model. This result is consistent with the findings of Abdulai and Delgado (1999) who indicated that access to infrastructure tends to exert a positive effect on non-farm work participation decisions of married men and women in rural Northern Ghana.

Access to primary schools in the community of a cocoa producer (INFRAPRI) is significantly different from zero at the 10 percent level. An increase in access to primary schools by 1 percent increases the probability of a producer diversifying by 0.25 percent. Access to primary schools tends to increase the likelihood that the cocoa producer will send his children to school and thus increase the financial responsibility of the producer. This is likely to motivate the producer to increase household income through diversification.

Access to postal services in the community of a producer (INFRAPOS) is significantly different from zero at the 10 percent level. An increase in access to postal

services by 1 percent increases the probability of a producer diversifying by 0.31 percent. Postal services enhance the flow of information to and from the producer, preventing him from travelling long distances to deliver or post letters in other towns. Thus the producer is able to save time for investment in other income-generating activities.

Access to health facilities in the community of a producer (INFRACLI) is significantly different from zero at the 5 percent level. The marginal effect implies that a 1 percent increase in access to health facilities is likely to increase the probability of diversifying by 0.07 percent. The health of a cocoa producer is very crucial to his productivity. The siting of a health centre within the community of a producer is likely to motivate the producer to seek orthodox medical treatment from the centre when sick. Thus, the farmer's health will be enhanced and this will provide him with enough energy to engage in other activities beside cocoa production.

Surprisingly, access to telecommunication facilities (INFRATEL) exerts a significant negative effect at the 1 percent level in the study. An increase in access to telecommunication facilities by 1 percent decreases the probability of a producer diversifying by 0.06 percent. The cost of using telecommunication facilities in the communities of the cocoa producers could be the reason for this significant negative effect. The cost may be too high and unaffordable to the cocoa producers, causing diversion of finances for investment in other economic activities into telecommunication facilities. The use to which the telecommunication facilities are put may also be important for explaining this negative effect. When used for communication that will enhance the economic activities, it is likely to have a positive

effect. However, it is likely to have a negative effect when used for other issues not relating to the economic activities of the cocoa producer.

The age of a cocoa farm (between 21 and 30years) is significantly different from zero at the 1 percent level. The relationship is negative, implying that there is a lower level of diversification in the case of producers with cocoa trees between 21 and 30 years compared with those, which are less than 21 years and those, which are more than 30 years old. However, the effect of the age of cocoa trees more than 50 years (AGECOFA6) is not significant even at the 1 percent level. Between 21 and 30 years the yield of cocoa trees begin to decrease since the average lifespan of a cocoa tree ranges from 25 to 30 years, depending on the variety.

Thus, the cocoa producer needs to intensify management practices such as weeding the floor of the cocoa farms and applying fertilisers in order to raise yields. This involves cost and time, and less time and resources are made available for investment in other crops and economic activities. Thus, diversification decreased with increasing age of the cocoa trees.

Number of dependants of a cocoa producer is an indication of the family size. The number of dependants is given by the total number of children, wards, wife (if the farmer is a male) and other extended family members who depend on the farmer for their livelihood. It actually indicates the extent of financial responsibility on the farmer. The coefficient of the number of dependants ranging from 2 to 5 (NUMDEP2) is significantly different from zero at the 10 percent level and bears a negative sign. The a priori expectation here is that diversification increases as the number of dependants increase.

Table 5. LOGIT Results: Effects of the Determinants of Diversification

Convergence achieved after 30 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.	Marginal Effects
INFRAPRI	4.638794	2.445430	1.896923	0.0578*	0.25262
INFRASEC	3.025001	2.314554	1.306948	0.1912	0.46779
INFRAPOS	4.820049	2.640324	1.825552	0.0679*	0.30506
INFRACLI	4.324599	1.787088	2.419914	0.0155**	0.06600
INFRATEL	-11.64283	4.137081	-2.814261	0.0049***	-0.05677
ACCELOA	-0.194058	0.896813	-0.216386	0.8287	-0.02750
ACESEXT	-0.053469	0.866630	-0.061698	0.9508	-0.00250
AGECOFA1	-0.465238	1.458997	-0.318875	0.7498	-0.08730
AGECOFA3	-4.253615	1.532548	-2.775519	0.0055***	0.02326
AGECOFA6	-2.818231	1.979652	-1.423599	0.1546	-0.36834
INFRADAY	0.363416	0.996440	0.364714	0.7153	0.07401
FAMERAGE	0.073147	0.050290	1.454521	0.1458	0.00911
GENDER	-0.208150	1.313451	-0.158476	0.8741	-0.02291
NUMDEP2	-1.859553	1.032223	-1.801503	0.0716*	-0.12360
NUMDEP6	-1.212722	1.587707	-0.763820	0.4450	-0.30288
NUMWIVES	-0.164685	0.695393	-0.236823	0.8128	-0.02506
EDULEV1	-0.238120	1.064806	-0.223627	0.8230	-0.03469
NUCOFAR1	-0.419103	1.872836	-0.223780	0.8229	-0.06108
NUCOFAR3	2.800704	1.390367	2.014364	0.0440**	0.11781
NUCOFAR6	1.315066	1.664164	0.790226	0.4294	0.32221
DISRESFA	-0.029131	0.122571	-0.237668	0.8121	-0.00444
SAVBANK	1.753383	0.995828	1.760728	0.0783*	0.12654
FARMOWN4	-4.873674	1.905441	-2.557767	0.0105**	0.05064
SIZCOFA1	2.704207	1.529179	1.768405	0.0770*	0.192191
SIZCOFA3	40.49898	41178174	9.84E-07	1.0000	0
SIZCOFA6	-0.295907	1.138969	-0.259802	0.7950	-0.16298
ETHASANT	-0.127646	0.824734	-0.154772	0.8770	-0.01377
YEFORED1	2.037243	2.202362	0.925026	0.3550	0.46648
LANDOWN7	33.69117	4.64E+08	7.25E-08	1.0000	0
MOWNLAN2	0.908634	1.105588	0.821856	0.4112	0.21100
SOPINION	0.622727	1.062314	0.586199	0.5577	0.15361
EDULEV3	39.59968	70204762	5.64E-07	1.0000	0
C	-5.638123	4.225701	-1.334246	0.1821	-0.83974

Mean dependent var	0.936508	S.D. dependent var	0.244331
S.E. of regression	0.210505	Akaike info criterion	0.524854
Sum squared resid	9.704423	Schwarz criterion	0.987041
Log likelihood	-33.13154	Hannan-Quinn criter.	0.710828
Restr. Log likelihood	-59.59040	Avg. log likelihood	-0.131474
LR statistic (32df)	52.91773	McFadden R-squared	0.444012
Probability(LR stat)	0.011439	Included observations: 252	

Obs with Dep=0	16	Total obs	252
Obs with Dep=1	236		

*** Denotes significance at 1percent level, ** at 5percent level and * at 10 percent level.

Definitions of variables are presented on page 47.

Source: Author's computations based on primary survey data

Table 6. Definition of variables

Variable	Definition
INFRAPRI	Access to infrastructure (Primary school)
INFRASEC	Access to infrastructure (Secondary school)
INFRAPOS	Access to infrastructure (Postal services school)
INFRACLI	Access to infrastructure (Health services school)
INFRATEL	Access to infrastructure (Communication facilities)
INFRADAY	Access to infrastructure (Day care centres)
ACCELOA	Access to loan or credit from formal sources
ACESEXT	Access to extension services
AGECOFA1	Age of cocoa trees less than 8 years
AGECOFA3	Age of cocoa trees ranging between ranging from 21 years to 30 years
AGECOFA6	Age of cocoa trees ranging above 50 years
FAMERAGE	Cocoa producer's age
GENDER	Gender of cocoa producer
NUMDEP2	Number of dependants ranging between 2 and 5
NUMDEP6	Number of dependants above 15
NUMWIVES	Number of wives of male cocoa producer
EDULEV1	Whether or not producer has no formal education
EDULEV3	Secondary education or vocational training as the highest level of education of cocoa producer.
NUCOFAR1	Less than 5 years of experience in cocoa farming
NUCOFAR3	Number of years of experience in cocoa farming ranging from 16 to 30 years
NUCOFAR6	Above 50 years of experience in cocoa farming
DISRESFA	Distance from residence to farm
SAVBANK	Whether or not a farmer saves at a bank
FARMOWN4	Whether or not farm is family ownership or not
SIZCOFA1	Size of cocoa farm ranging from 1 to 4 acres
SIZCOFA3	Size of cocoa farm ranging from 9 to 12 acres
SIZCOFA6	Size of cocoa farm above 20 acres
ETHASANT	Whether or not producer's ethnicity is Asante or not
YEFORED1	Less than 5 years of formal education
LANDOWN7	Whether or not farm land is leasehold
MOWNLAN2	Whether or not farm land was purchased by producer
SOPINION	Opinion leader as a social status of cocoa producer

Source: Author's Definitions.

It is expected that a greater family size and financial responsibility will motivate a cocoa producer to diversify in order to increase his income to cater for his family. The results imply that for this range of dependants (specifically, 2 to 5 people), an increase in number of dependants by 100 percent is likely to reduce diversification by approximately 12 percent. Thus, diversification decreases as the number of dependants increase. This is because, as the number of dependants and family size increases, more expenses are incurred and less cash is made available for investment in other economic activities. In this respect, the results reveal an important observation that although a producer may diversify to increase income to take care of the needs of the family; more expenses are made on the family, as it grows larger. Consequently, less cash is made available for investment in other economic activities.

The coefficient of the number of years of experience in cocoa farming ranging from 16 to 30 years (NUCOFAR3) is significantly greater than zero with a positive effect at the 5 percent level. This suggests that cocoa producers who have been cultivating cocoa for 16 to 30 years tend to diversify than those who have been cultivating cocoa for less than 30 years. This finding is consistent with that of Pope and Prescott (1980) concerning experience having a positive effect on diversification behaviour of farmers in the Corn Belt in California, USA. The marginal effect of a one-year increase in the number of years of farming is an increase in diversification by 0.12 percent. As a farmer gains experience in farming through an increasing number of years' involvement in farming, he gains enough skills in cocoa farming and this increases his confidence to cultivate other perennial and annual crops and also add livestock and off-farm activities. In addition, as the number of years of farming

experience increases, there is the likelihood that a farmer will gain access to land to engage in other diversifying farm and off-farm activities.

Whether or not a farmer saves at a bank (SAVBANK) is significantly important in the estimated diversification equation with a positive effect at the 10 percent level. A farmer saving at a bank has the likelihood of keeping revenues from cocoa in order to invest in other farm and off-farm activities. In addition, a farmer who saves at a bank has the likelihood of being granted loans from the bank. As farmers faced a constraint of lack of loan (Section 4.6), earnings from cocoa are saved for investment in other activities. This lends support to the notion of Abdulai and CroleRees (2001) that in areas where credit constraints are binding, households generally have to rely on earnings from cash crops or savings to invest in non-farm activities.

Family farm ownership limits access to the use of land for diversified activities. This is due to the fact that the use of family farm is in the interest of family members. In addition, family members require that caretakers cultivate only cocoa to avoid disputes in sharing farm products either through 'abunu' or 'abusa' Family ownership of farm (FARMOWN4) had a negative significant effect on diversification at the 5 percent level. The marginal effect is –0.0506.

The size of cocoa farm ranging from 1 acre to 4 (SIZCOFA1) acres is significant with a positive effect at 10 percent level. This finding is consistent with that of Pope and Prescott (1980) who observed that farm size had a positive effect on diversification. Abdulai and CeoleRees (2001) in observing that landholding exerts a positive effect on diversification receive support from this study. This finding is also consistent with that of Reardon et al (1992) who suggested that for the Sudanian zone

of Burkina Faso, greater land holding stimulated greater diversification. This result suggests that for farm sizes ranging from 1 to 4 acres, an increase in farm size by 1 percent increases diversification by 19.2 percent. As land holding increases, the farmer gains enough land to engage in other activities.

However, farm size is not significant for higher ranges of farm sizes (that is, more than 4 acres). Notably, for larger sizes of farms, the scale of cocoa production may be too high to enable the farmer participate in other activities. Thus, the effect of farm size seems to be important for only small holders. It can also be argued that small holders are likely to be the poor who desire to diversify to increase their income level, while large holders are likely to be wealthy already and tend to diversify less.

4.6. Constraints to Diversification

Cocoa producers who engage in diversification are faced with peculiar constraints, depending upon the enterprises in the diversification matrix. In the present study, the cocoa producers ranked their responses concerning these constraints. The Kendall's Concordance Coefficient method is again employed to determine whether there is concordance among the constraints ranked by the producers and the relative importance of these constraints. Capital constraint turns out to be very important to cocoa producers in all categories of diversification. Capital, either in terms of financial or material resources, is a prerequisite for all forms of investments. Investment in other perennial crops, annual crops, animal production and off-farm activities such as trading require material and financial resources. Off-farm activities such as driving and teaching also require human

hired for cocoa activities will not be involved in activities of other crops besides cocoa. In addition, the labour market for the other crops is not as structured as that for cocoa, where there are fixed charges for daily labour wages. Thus the problem of lack of labour for activities relating to crops other than cocoa is real.

Lack of market for produce and inadequacy of land for the cultivation of other crops equally rank as the fourth important constraint. The market for other perennial and annual crops is not structured as it is for the case of cocoa and producers have to find their own means of getting the produce purchased by either middlemen or final consumers. Unlike the purchasing points of cocoa which are located in the villages of the cocoa producers, there are no readily available purchasing points for other crops and producers have to transport their produce to the roadside to sell by the streets or to the market on market days.

Land ownership is a crucial factor in cocoa producers' decision to diversify. Cocoa producers cultivating on family land have limitations in the decision to cultivate other crops in addition to cocoa. Inadequacy of land is an important constraint (Table 7). Notably, close to 30 percent of the producers interviewed cultivate on family land and have limited access to the use of the land for diverse purposes.

4.6.2. Constraints Faced by Cocoa Producers Diversifying into Animal Production

Cocoa farmers diversifying into animal production encounter constraints, which vary with the types of animal being reared. Cocoa producers in small ruminant production encounter constraints such as destruction of crops by the animals, whereas cocoa producers in poultry production primarily encounter constraints in the form of

Table 7. Ranking of Constraints to Diversification into Other Perennial and Annual Crop Production

Constraint	Total Sum of Ranks	Overall Rank
1. Inadequate equity capital	501	1
2. Inaccessibility of loan	722	2
3. Lack of labour throughout the period of production	1025	3
4. Inadequacy of land	1108	4
5. Lack of market	1108	4
6. Lack of storage facilities	1123	6
7. Lack of inputs	1146	7
8. Bad weather	1583	8

Source: Author's computations based on primary survey data.

lack of access to veterinary drugs and services. However, farmers in all forms of animal production to some extent expressed concern with lack of access to veterinary drugs and services. Again, a general concern with inadequacy of equity capital was expressed as the most important constraint to the addition of animal production to cocoa production. Financial and material resources cannot be ignored in investment in animal production. Limitations with regards to these resources limit the scale of production.

The empirical results indicate that access to market is not a very important constraint, and an increase in production is likely to attract the expected demand (Table 8).

Inaccessibility to veterinary drugs and services rank as the second most important constraint to diversification into animal production. It is not surprising that these two factors have the same rank, as they are closely related. The Ashanti Region is known to be a crop-producing (and in fact a cocoa producing) region, since the soil and climatic conditions are more conducive to crop production than livestock production. Therefore, it is likely that government and private entrepreneurs provide resources for crop production rather than resources and incentives for animal production.

As lamented by the cocoa producers interviewed, the destruction of crops by sheep and goats in the area is a problem to cocoa producers and this is likely to occur when the animals are reared close to the farms. However, for cocoa producers who have their farms located far from their residence, this problem is likely to be minimised, although it may not be convenient for producers to walk long distances to their farms. Therefore, for cocoa producers rearing livestock close to their crop farms, it is advisable to either fence the farmyards or house the livestock in pens. In situations where the livestock is reared exclusively on free- range systems, it is advisable to monitor their movement in order to prevent them from damaging crops.

Table 8. Ranking of Constraints to Diversification into Animal Production

Constraint	Total Sum of Ranks	Overall Rank
1. Inadequate capital	270	1
2. Inaccessibility to veterinary services	381	2
3. Inaccessibility to veterinary drugs	381	2
4. Animal destroying and feeding on crops	388	4
5. Lack of labour	449	5
6. Lack of technical know-how	473	6
7. Lack of market	490	7
8. Lack of storage facilities	526	8
9. Mortality of animals	652	9

Source: Author's computations based on survey data.

4.6.3. Constraints Faced by Cocoa Farmers Diversifying into Off-Farm Activities

A range of constraints are faced by cocoa producers diversifying into off-farm activities such as teaching, trading, sewing, driving, palm-wine tapping and carpentry. Some cocoa farmers work as Civil Servants and Purchasing Clerks in addition to cocoa production. The Kendall's Concordance Coefficient is again employed to test the concordance among the ranks for the constraints as given by the producers. The computed Kendall's Concordance Coefficient here is 0.007373 and the corresponding Z value was calculated is 0.505. The critical value for Z ($Z_{9.76, 478.2}$) is

0.4256. The calculated Z value was greater than the critical Z computed value; thus, the null hypothesis of no concordance is rejected. Therefore, the sum of ranks is used to obtain the overall ranks for the constraints faced by cocoa producers diversifying into off-farm activities.

From Table 9 lack of equity capital constitutes the most compelling factor for cocoa producers engaged in off-farm activities. Most of the off-farm activities such as gari-processing, carpentry, trading, batik and soap making, sewing and palm-wine tapping require working capital. These activities also require financial resources to purchase inputs. It will therefore be difficult for the cocoa producers to engage in these activities without adequate access to capital.

Lack of time for cocoa production activities is another important impediment faced by cocoa producers in off-farm diversification. Due to their involvement in off-farm activities, some cocoa producers spend little time on their cocoa farms and this has tended to have a negative effect on their cocoa production.

Lack of effective demand by customers is a very important restraint for producers in trading activities. Some customers who purchase on credit refuse to pay their debt while at the same time there is no adequate market for the trade items. Low market could be as a result of low population density since most of the producers are sited at low populated areas. Abdulai and Delgado (1999) observed that population density is one of the determinants of the producer decisions concerning participation in non-farm work by married men and women in rural Northern Ghana.

Lack of loan and cost of labour equally ranked as the fourth most important reason for participation in off-farm activities. Loans from formal sources (both commercial and rural banks) are inaccessible to some extent to the cocoa producers

who apply for loans. The producers claim their applications are not attended to as they follow up on several occasions. It is probable that the number of loan applications received by the banks exceeds their available financial resources. As cocoa producers diversify, their schedules of activities become numerous and family labour alone is not enough to undertake such activities. Hence they need to hire labour to undertake activities concerning their cocoa farms and other diversification activities. This requires financial resources, which may not be available due to the fact, that loan from formal sources is not accessible to the cocoa producers. Labour in the study area is available. However, the cost of engaging the services of a labourer for any kind of activity may be high. For instance the average wage rate for labourers working on farms of producers is ¢10,000 per day, as at the time of conducting the study. For a producer to engage in off-farm activities he or she needs to employ the services of a labourer who will assist in farming activities. As a result producers are constrained from engaging actively off-farm activities if they cannot afford the labour cost.

Lack of inputs was the sixth important constraint for off-farm diversification. For vocational activities such as soap and batik making, inputs are very important for an entrepreneur to remain in business.

Table 9. Ranking of Constraints to Diversification into Off-Farm Activities

Constraint	Total Sum of Ranks	Overall Rank
1. Lack of capital	94	1
2. Lack of time	108	2
3. Lack of effective demand	129	3
4. Lack of loan	130	4
5. Cost of labour	130	4
6. Lack of inputs	132	6
7. Long distances to sites of activities and to procure inputs and trade items	136	7
8. High cost of inputs	137	8
9. Lack of storage facilities	137	8
10. Lack of electricity	138	10

Source: Author's computations based on primary survey data

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

It is important that a socio-economic study of this nature benefits the respondents as well as contributing to the body of knowledge. The behaviour of the cocoa producer is of great interest to the government since large amounts of foreign revenue are earned from cocoa. Therefore any study that will generate policy recommendations that will benefit cocoa producers is certain to be in the interest of the State of Ghana. This Chapter presents a summary of the results of the study and the respective policy recommendations. The Chapter also enlists the limitations of the present study and the reasons why some variables were not included. The Chapter concluded with suggestions for future research based on the limitations.

5.1. Summary and Policy Implications

The present study has identified the specific reasons why cocoa producers in the Ashanti Region engage in the cultivation of other perennial crops, annual crops, and animal rearing and off-farm economic activities. It has also identified the socio-economic determinants of this phenomenon, viz., diversification. It has quantified the marginal effects of these determinants on cocoa farmers' diversification behaviour, thus indicating the level of change in diversification behaviour with a unit change in any of the socio-economic determinants using a logit model. The study has further analysed the specific constraints faced by the cocoa producers in diversifying to the

various enterprises, using Kendall's Concordance Coefficient and information on the ranking of these constraints by the cocoa producers.

Generally, producers diversify into all other forms of enterprises to increase their income levels. These producers in perennial crop production such as oil palm, citrus and teak diversify purposely to increase their level of income and wealth, as well as to regularise cash flow throughout the year. Similarly, those producers in animal production diversify to increase income and to expand their sources of income. Producers engaged in off-farm activities diversify in order to expand their sources of income. However, cocoa producers in annual crop production diversify primarily for household consumption and secondly to increase income level. These responses from the producers in all categories of diversification attest to the fact that the income level of producers is an important factor in inducing diversification. It further suggests that the problems of low income and poverty could be solved through diversification. Hence, care must be taken to consider the factors identified in the present study to stimulate diversification, in order to increase producers' income and in the long run enhance their livelihood.

The results of the Logit model suggest that access to infrastructure (specifically, primary schools, postal services and health facilities) tend to enhance diversification behaviour of cocoa producers in the Ashanti Region. Infrastructure is part of public goods and services provided by governments. Thus, a conscious effort should be made by government to provide these pieces of infrastructure to cocoa growing communities in Ghana. Cocoa being a major source of tax revenue for the economy needs much attention in terms of policy. It is noteworthy, once again, that diversification does not indicate an outright shift from cocoa to other crops, livestock

and off-farm activities but rather a combination of these activities with cocoa cultivation. As suggested by the results of the study, the income levels of cocoa producers are low and this could cause these producers to shift out of production to other economic activities. This condition endangers the sustenance of the cocoa industry in Ghana. Thus, producers need to be encouraged and guided to diversify in order to increase their income levels, expand their sources of income and regularise their cash flow so as to remain in production. Hence, the government must provide the conditions favourable for diversification. A provision of infrastructure must be backed with an awareness creation to encourage their utilisation for other economic activities. Communication facilities, for instance must be used cautiously for economic activities as well as social activities.

The age of the cocoa farm ranging from 21 to 30 years tends to exert a negative effect on diversification, as the present study shows. As the cocoa trees approach the ages of 21 to 30 years, the likelihood of diversification begins to decrease. As the cocoa trees approach the end of their productive lifespan, which is about 25 to 30 years, the yield drops and the producer spends so much time and money to maintain the yield. This finding brings a suggestion to producers to replant cocoa trees as soon as they approach the end of their lifespan. Producers should make a conscious effort to replant before the yield deteriorates.

Number of dependants of a producer, depicting household size, tends to exert a significant negative effect on diversification in the present study. As number of dependants increases, diversification tends to decrease. The results suggest that as much as producers diversify to increase their income, probably to cater for their families, it is likely that as the number of dependants increase, their financial

responsibility increases such that they have inadequate resources left for investment in other activities. Thus, as number of dependants increase, they diversify the less to have more time for their households. A conscious effort should therefore be made by government to integrate family planning programmes with the provision of health facilities in the communities of producers. This will reduce the number of births and cause farmers to save enough financial resources for investment in diversification activities. One could, however, well argue that this would reduce access to family labour. Access to wage labour appeared not to be an important constraint and this seems to imply that there is an abundance of labour in the communities of the producer.

The number of years in farming, depicting producer experience exerts a significant positive effect on diversification in this study. This finding suggests that farming experience is required for diversification. It is suggested that government through extension officers should provide the necessary skills required to cultivate other perennial and annual crops. The most common other perennial crop grown in the study area is oil palm. It is necessary that the agricultural extension officers provide the needed skills and knowledge on oil palm production to cocoa. In addition, producers expressing the desire to diversify must be given the necessary skills and guidance to continue with cocoa cultivation and also diversify. It is further recommended that government should provide incentives to producers for the cultivation of other crops and in so doing, they must be made aware that such incentives are provided because of the fact that they are cocoa producers.

Whether or not a producer saved at the bank is an important determinant of diversification in the present study. A producer's choice of saving at a bank indeed

exerts a positive effect on diversification. This suggests that producers must be encouraged to save with either the commercial or rural banks within their reach. A conscious effort should to be made by bankers to institute simple and comprehensive procedures of saving. The initial minimum deposit required by banks must be reduced to the level which is affordable to farmers and that will stimulate them. Savings products must be designed with benefits that will motivate them to save, especially during harvesting periods.

The empirical results obtained in the present study shows that family farm ownership tends to exert a negative effect on diversification. As family's interests interfere with the use of land, it is required that government reviews the forestland policy to enhance diversification by caretakers. Traditional rulers must review land tenure policies to enhance flexibility in the use of family farmlands by caretakers or any member of the family as much as the uses are environmentally accepted and economical. Again, local and traditional authorities must encourage diversification through the leasing of lands to farmers who intend to diversify. Finally, legislations must encourage sole ownership of land and also increase land holdings of smallholders. As diversification increases with an increase in farm size for smallholders, land legislations must encourage increasing sizes of land holding of smallholders.

The responses from producers in the present study, concerning all forms of diversification, indicate that capital inadequacy is the most constraining factor regarding diversification. For producers involved in crop diversification, lack of loans is the next important constraint. Capital inadequacy is linked to accessibility to loan or credit. It is not surprising that producers saving at the bank tend to diversify the

more. This implies that most a producers who diversify tend to invest their savings from cocoa in other economic activities. As much as producers are encouraged to save at the banks, bankers should increase their disbursement of loans to these producers. It is also important that qualified private investors set up more rural banks in cocoa growing areas to enable producers gain access to loan from such formal sources at affordable interest rates. This will serve the growing number of producers who apply for loans. A review of the agricultural policies is required to enhance the provision of loans to producers for engagement in diversification activities.

One important constraint facing farmers in off-farm activities is lack of time for production and family issues. This requires the institution of diversification policies that will lead to the investigation of producers' activities, to guide them on the portfolio of enterprises in which to invest. This will cause the producers to render adequate attention to production activities.

Producers diversifying into animal production encounter another important constraint, which is lack of veterinary services and drugs. It is hereby recommended that government intensify veterinary extension services to producers who also rear animals. This requires that non-specialised extension officers from the Ministry of Food and Agriculture (MOFA) take care of all extension needs of producers and not only the extension needs relating to cocoa production. In this era of decentralisation of the Directorate of Extension Services, it is important that extension officers make a conscious effort to take care of all extension needs of cocoa producers. It is also necessary that extension officers in cocoa growing areas receive requisite professional extension skills from their district development officers. With regards to the constraint of lack of veterinary drugs, it is recommended to government to provide veterinary

drugs to livestock producers in cocoa growing areas as much as it provides chemicals and spraying services to producers. Private entrepreneurs retailing veterinary drugs have a clue to increase their market segment to cocoa growing areas since 39.14 percent of the producers interviewed in this study are also into animal production.

5.2. Limitations of the Study and Suggestions for Future Research

Some variables known to be socio-economic determinants of diversification behaviour in the relevant existing literature were not included in the present study. Wealth level, which is conceived as net worth and income level of the producer were excluded from the present study. This is due to the constraints encountered in measuring the wealth and total income of the cocoa producer. Most of the producers could not recall when they acquired their assets and also were not willing to declare the exact debts they owed. This made it difficult to accurately compute the value of total assets and liabilities. Total income was excluded due to the fact that most producers were in annual crop production mainly for subsistence consumption and could not accurately value the cost of food crops consumed at home. Thus, to avoid errors, total income was not included. Future research, in determining the effect of wealth and income on diversification among producers, should use indirect means of obtaining information concerning the wealth and income levels of producers.

This study covers the effects of the socio-economic determinants of diversification; unfortunately, the costs of the determinants such as infrastructure were not included in the study. Thus, it was difficult to identify the cause of the negative causality of the telecommunication variable. Future research should therefore include

the costs of infrastructure in future studies concerning infrastructure as a determinant of diversification.

This study must identify simpler and tactful ways of determining the value of assets and liabilities of farmers and also identify indirect means of obtaining farmers' total income. Future research needs to analyse the effects of the cost of telecommunication facilities and also the use to which they are put in cocoa settings. Such a study will explain the negative causality of the telecommunication variable.

Finally, it is recommended that future research should analyse the optimal portfolio of enterprises into which cocoa producers can invest and at the same time not affect his attention for cocoa production activities. This is necessary to guide cocoa producers on the selection of a combination of enterprises that minimises risk and increases expected returns and also time allocation for the various enterprises.

Appendix I

Questionnaire

Questionnaire Number:

Date of interview:

1. Name of farmer.....
2. Age of farmer..... 3. Ethnicity .....
4. District..... .... Community.....
6. Location of farm .....
7. Residence of farmer.....
8. Distance from residence to farm.....
9. What is your highest level of education?
    a. No schooling/non-formal
    b. Primary/JSS/Middle school
    c. Secondary/SSS/Vocational school
    d. Post-secondary e.g. agricultural training college
    e. University/Polytechnic
10. How many years of formal education do you have?

< 5yrs	6-9yrs	10-13yrs	14-16yrs	>16yrs

11. Gender: a. Male b. Female
12. Marital status:
    a. Married
    b. Single
    c. Divorced
    d. Widowed
    e. Separated
13. Social status:
    a. Chief b. Assemblyman
    c. 'Odikro' d. 'Okyeame'
    e. Chief farmer f. Opinion leader
    g. Pastor h. Elder

f. Party Representative i. 'Abusuapanyin'

j. Other specify

14. Number of wives: .....

15. Number of dependents (i.e. children, wards and wife (ves) and husband (in case the interviewee is a female)).

<2	2-5	6-8	9-11	12-15	>15

16. Are you a native of this town? 1) Yes 2) No

17. If no, when did you arrive in this town? .....

18. Number of years in cocoa farming:

a. Years.....

b. Year group:

<5yrs	6-15yrs	16-30yrs	31-40yrs	41-50yrs	>50yrs

19. Year of becoming a farmer?.....

20. Do you cultivate only cocoa for income? 1) Yes 2) No

21. If yes, why are you not interested in any other crop or activity?

a. Lack of interest in other crops.

b. Low income from other crops.

c. Cocoa being more lucrative than crops.

d. Lack of time for engaging in other crops.

e. Landowner not interested in other crops aside cocoa.

22. How old is your cocoa farm?

a. Actual age of cocoa farm.....

b. Cocoa farm age group:

<8yrs	9-20yrs	21-30yrs	31-40yrs	41-50yrs	>50yrs

23. What is the size of your farm? (Acres)

a. Actual farm size.....

a. Farm size group:

1-4	5-8	9-12	13-16	17-20	>20

24. Are you the one who cultivated the cocoa currently on the farm?

    1) Yes 2) No

25. In which year were the cocoa crops cultivated? .....

26. Have you ever received an award for farming? 1) Yes 2) No

27. If yes, how many times have you received an award? .....

28. What is the form of ownership of the **farm**?

    a. Sole ownership b. 'abunu' c. 'abusa'

    d. Family ownership e. Others, please specify

29. If sharecropping ('abunu' or 'abusa'), explain the form of sharing, whether it is crop or revenues . .....

30. If Q28 is sole ownership, through what means did you own the farm?

    a. Purchasing b. Gift c. Inheritance d. Mortgage

    e. Self-cultivation f. Others, please specify

31. What is the form of ownership of **land?**

    a. Sole ownership b. Family ownership

    c. 'abunu' d. 'abusa' e. Others, please specify

32. Through what means did you own the land?

    a. Gift b. Purchasing c. Inheritance d. Mortgage e. 'abunu'

    f. 'abusa' g. Others, please specify

33. How many bags of cocoa did you sell at the end of last season?

    .....

34. What is the weight (kg) per bag of cocoa? .....

35. What was the cost per kilogram of cocoa beans? .....

36. Did you obtain any extension service in the last season?

    1) Yes 2) No

37. Did you obtain any information on the market and prices the last season?

    1) Yes 2) No

38. From where did you obtain the information?

    a. Extension Officer b. Radio c. Newspaper

    e. Purchasing Clerk f. Colleague farmer d. TV

    g. Others specify

39. Do you save at a bank? 1) Yes 2) No

40. Where do you save?

a. Ghana Commercial Bank b. Standard Chartered Bank

c. Barclays Bank d. Social Security Bank

e. Rural Bank f. Credit Union

g. Others, specify

41. Do you often find the need for extra capital in your production?

1) Yes 2) No

42. From where do you often obtain loans for cocoa production?

a. Money-lenders b. Friends and relatives c. Rural banks

d. Commercial banks e. Purchasing Clerk

f. Others, please specify

43. If from the bank, where is it located? (Name the town in which it is located).

.....

44. What is the interest rate of your bank or moneylender? (Indicate which).

45. What infrastructure do you have in your community?

a. Hospital b. Clinic

c. Primary school d. Day care centre

e. Secondary school f. Post Office

g. Telecommunication facilities h. Good roads

CROP DIVERSIFICATION

1. What other perennial crops are you growing in addition to cocoa?

Type of crop	Date of cultivation	Size of plantation (Acres)	Reasons for adding to cocoa
Oil palm			
Rubber			
Coffee			
Teak			
Timber			
Citrus			
Others, please specify			

2. What other annual crops are you growing in addition to cocoa?

Type of crop	Date of first cultivation	Size of plantation (Acres)	Reasons for growing in addition to cocoa
Cassava			
Maize			
Yam			
Plantain			
Cocoyam			
Tomato			
Pepper			
Onion			
Garden eggs			
Okro			
Banana			
Rice			
Others, specify			

3. Ranking of reasons for adding perennial and annual crops

Reasons for adding Perennial crop(s)	Rank	Reasons for adding annual crop(s)	Rank
1. To have assets for Intergenerational transfer		1. Subsistence consumption	
2. To increase wealth level		2. To have additional income	
3. To increase income level		3. To maximise the use of land	
4. Difficulty in replanting some more cocoa trees after felling tree.		4. To increase income level	
5. To have regular income		5. To have finances all the time	
6. Others please specify		6. Diminution of the risk of the prices and revenues of cocoa.	
		7. Others, please specify	

4. What are the constraints you encounter with crop diversification? (Tick as many as appropriate and rank in descending order of importance).

Constraint	Rank
1) Lack of labour throughout the period of production	
2) Lack of storage facilities for other crops	
3) Lack of market for the other crops	
4) Inadequate capital	
5) Inaccessibility of loan	
6) Unavailability of inputs of other crops	
7) Inadequacy of land for all crops	
8) Bad weather	
9) Others, please specify	

5. What is your perception concerning wealth of those who diversify

.....

.....

.....

AGRICULTURAL DIVERSIFICATION

1. What animals do you rear for income?

Animal	Number	Reasons for adding to cocoa
1. Broilers		
2. Layers		
3. Turkey		
4. Ducks		
5. Sheep		
6. Goats		
7. Cattle		
8. Fishes		
9. Local fowls		
10. Others, please specify		

2. What are the constraints you encounter with agricultural diversification? (Please rank them in descending order of importance).

Constraint	Rank
1. Animal destroying and feed on crops	
2. Lack of labour	
3. Inaccessibility to veterinary services	
4. Inaccessibility to drugs	
5. Lack of storage facilities	
6. Lack of market for animal produce	
7. Inadequate capital	
8. Lack of experience	
9. Others, please specify	

OFF-FARM DIVERSIFICATION

1. What are the off-farm activities in which you are involved for income?

Activity	Reasons for undertaking activity
1. Teaching	
2. Driving	
3. Trading	
4. Baking	
5. Gari-processing	
6. Sewing	
7. Carpentry	
8. Carving	
9. Building construction	
10. Lotto agent	
11. Others, specify	

3. What are your constraints to off-farm diversification? (Please rank them).

Constraint	Rank

Appendix II

Types of Annual Crops Cultivated by Cocoa Producers

Crop	Frequency	Percentage of respondents*
1. Cassava	261	93.21
2. Maize	236	84.29
3. Plantain	249	88.93
4. Yam	124	44.29
5. Cocoyam	186	66.43
6. Tomato	31	11.07
7. Pepper	49	17.50
8. Garden eggs	20	7.14
9. Onion	9	32.14
10. Okro	26	9.29
11. Rice	11	3.93
12. Banana	2	0.71
13. Pineapple	2	0.71
14. Beans	1	0.35

* Percentages are based on the total number of producers in annual crop production (280). Due to multiple responses, percentages do not sum to 100.
Source: Author's computations based on survey data

Appendix III

Types of Animals Reared by Cocoa Producers

Type of animal	Frequency	Percentage of respondents (%)*
1. Local fowls	36	29.75
2. Broilers	17	14.05
3. Layers	17	14.05
4. Turkeys	6	4.96
5. Ducks	16	13.22
6. Sheep	67	55.37
7. Goats	65	53.72
8. Cattle	5	4.13
9. Fish	2	1.65
10. Pigs	4	3.31
11. Snails	1	0.83
12. Rabbits	1	0.83

* Percentages are based on the total number of producers in annual crop production (121). Due to multiple responses, percentages do not sum to 100.
Source: Author's computations based on survey data.

Appendix IV.

Types of Off-Farm Activities Undertaken by Cocoa Producers

Type of activity	Frequency	Percentage (%)*
1. Teaching	7	7.22
2. Trading	40	41.23
3. Driving	5	5.15
4. Gari-processing	6	6.19
5. Sewing	4	4.12
6. Carpentry	3	3.09
7. Building construction	1	1.03
8. Lotto agent	1	1.03
9. Purchasing clerk	7	7.22
10. Civil service	7	7.22
11. Mining	6	6.19
12. Palm wine tapping	8	8.25
13. Transport services	2	2.06
14. Chop bar operation	1	1.03
15. Miller	1	1.03
16. Traditional birth attendant	1	1.03
17. Batik making	1	1.03
18. Soap making	1	1.03
19. Hunting	1	1.03

Source: Author's Computations

* Percentages are based on the total number of producers in off-farm activities (97). Due to multiple responses, percentages do not sum to 100.

Appendix Va

Descriptive Statistics on the Variables Used in the Estimated Logit Model

Variable	INFRAPRI	INFRASEC	INFRAPOS	INFRACLI	INFRATEL	INFRADAY	ACCELOA	ACESEXT
Mean	0.97	0.19	0.13	0.33	0.13	0.64	0.16	0.56
Std. Error of mean	1.04E-02	2.35E-02	2.02E-02	2.80E-02	2.02E-02	2.85E-02	2.49E-02	2.87E-02
Median	1.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00
Std. Deviation	0.18	0.40	0.34	0.47	0.34	0.48	0.37	0.50
Variance	3.08E-02	0.16	0.12	0.22	0.12	0.23	0.13	0.25
Skewness	-5.375	1.559	2.163	0.722	2.163	-0.590	1.887	-0.235
Std. Error of Skewness	0.145	0.145	0.145	0.145	0.145	0.145	0.166	0.140
Kurtosis	27.084	0.432	2.696	-1.489	2.696	-1.663	1.576	-1.958
Std. Error of Kurtosis	0.288	0.288	0.288	0.288	0.288	0.288	0.330	0.280
Minimum	0	0	0	0	0	0	0	0
Maximum	1	1	1	1	1	1	1	1

Source: Author's computations based on survey data

Appendix Vb

Descriptive Statistics on the Variables Used in the Estimated Logit Model

Variable	FAMERAGE	AGECOFA1	AGECOFA3	AGECOFA6	NUMDEP2	NUMDEP6	DISRESFA	ETHASANT	SOPINION
Mean	55.52	8.97E-02	0.19	5.98E-02	0.27	7.24E-02	3.1497	0.69	0.23
Std. Error of mean	0.70	1.65E-02	2.26E-02	1.37E-02	2.61E-02	1.52E-02	0.2206	2.65E-02	2.45E-02
Median	55.00	0.00	0.00	0.00	0.00	0.00	2.0000	1.00	0.00
Std. Deviation	12.25	0.29	0.39	0.24	0.44	0.26	3.8460	0.46	0.42
Variance	150.09	8.19E-02	0.15	5.64E-02	0.20	6.74E-02	14.7918	0.21	0.18
Skewness	0.166	2.886	1.594	3.732	1.047	3.317	2.353	-0.847	1.274
Std. Error of Skewness	0.140	0.140	0.140	0.140	0.143	0.143	0.140	0.140	0.141
Kurtosis	-0.368	6.372	0.543	12.004	-0.909	9.064	6.891	-1.292	-0.379
Std. Error of Kurtosis	0.279	0.280	0.280	0.280	0.285	0.285	0.279	0.279	0.282
Minimum	24	0	0	0	0	0	0.00	0	0
Maximum	98	1	1	1	1	1	25.00	1	1

Source: Author's computations based on survey data

Appendix Vc

Descriptive Statistics on the Variables Used in the Estimated Logit Model

Variable	SAVBANK	NUCOFAR1	NUCOFAR3	NUCOFAR6	SIZCOFA1	SIZCOFA3	SIZCOFA6	FARMOWN4
Mean	0.55	2.97E-02	0.39	3.96E-02	0.16	0.19	0.14	5.96E-02
Std. Error of mean	2.88E-02	9.77E-03	2.81E-02	1.12E-02	2.09E-02	2.24E-02	1.97E-02	1.34E-02
Median	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Std. Deviation	0.50	0.17	0.49	0.20	0.36	0.39	0.34	0.23
Variance	0.25	2.89E-02	0.24	3.82E-02	0.13	0.15	0.12	5.38E-02
Skewness	-0.196	5.568	0.441	4.745	1.909	1.627	2.137	3.847
Std. Error of Skewness	0.141	0.140	0.140	0.140	0.140	0.140	0.140	0.141
Kurtosis	-1.975	29.197	-1.817	20.650	12.004	0.651	2.585	12.883
Std. Error of Kurtosis	0.281	0.279	0.279	0.279	0.280	0.280	0.280	0.281
Minimum	0	0	0	0	0	0	0	0
Maximum	1	1	1	1	1	1	1	1

Source: Author's computations based on survey data

Appendix Vd

Descriptive Statistics on the Variables Used in the Estimated Logit Model

Variable	LANDOWN7	MOWNLAN2	YEFORED1	EDULEV1	EDULEV3	NUMWIVES	GENDER
Mean	1.02E-02	0.25	5.26E-02	0.37	7.24E-02	0.89	0.80
Std. Error of mean	5.85E-02	2.53E-03	1.28E-02	2.77E-02	1.49E-02	3.78E-02	2.32E-02
Median	0.00	0.00	0.00	0.00	0.00	1.00	1.00
Std. Deviation	0.10	0.43	0.22	0.48	0.26	0.66	0.40
Variance	1.01E-02	0.19	5.00E-02	0.23	6.74E-02	0.43	0.16
Skewness	9.814	1.177	4.027	0.563	3.317	0.816	-1.472
Std. Error of Skewness	0.142	0.143	0.140	0.140	0.140	0.140	0.140
Kurtosis	94.966	-0.620	14.309	-1.694	9.064	2.341	0.167
Std. Error of Kurtosis	0.283	0.285	0.279	0.279	0.279	0.279	0.279
Minimum	0	0	0	0	0	0	0
Maximum	1	1	1	1	1	4	1

Source: Author's computations based on survey data

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