COCOA SWOLLEN SHOOT VIRUS DISEASE (CSSVD) AND THE LIVING STANDARDS OF COCOA FARMERS: EVIDENCE FROM CHORICHORI IN THE SEFWI AKONTOMBRA DISTRICT OF GHANA

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MPHIL ECONOMICS DEGREE

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DECLARATION

I hereby declare that, except for references to other people's works, which have been duly acknowledged, this thesis is the result of my own research work carried out in the Department of Economics, University of Ghana, Legon under the supervision of Dr. Abel Fumey and Dr. Yaw Asante.

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DEDICATION

TO MY PARENTS

MR. JAMES YAW AGYEMANG BOATENG

AND

MS. HANNAH MENSAH

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LIST OF ABBREVIATIONS/ACRONYMS

AMI	Area of Mass Infection
AMSECs	Agriculture Mechanization Services Enterprises Centres
CCP	Cadbury Cocoa Partnership
CCT	Conditional Cash Transfer
CHPS	Community-Based Health Planning and Services
COCOBOD	Cocoa Board
CODAPEC	Cocoa Disease and Pest Control
CP	Cardinal Probit
CPP	Convention People's Party
CRIG	Cocoa Research Institute of Ghana
CRIG	Cocoa Research Institute of Ghana
CSSV	Cocoa Swollen Shoot Virus
CSSVD	Cocoa Swollen Shoot Virus Disease
CSSVDCU	Cocoa Swollen Shoot Virus Disease Control Unit
Dev.	Development
DVD	Digital Versatile Disc
ERP	Economic Recovery Programme
EU	European Union
FA	Factor Analysis
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FASDEP	Food and Agriculture sector development policy
FND	Farm-Nonfarm Diversification
FOB	Free (or Fright) on Board
GAIP	Ghana Agricultural Insurance Programme
GDP	Gross Domestic Product
GEPA	Ghana Export Promotion Authority
GETIC	Ghana Export Trade Information Centre

GLSS	Ghana Living Standard Survey
GNP	Gross National Product
GPRS	Ghana Poverty Reduction Strategy
GSFP	Ghana's School Feeding Programme
GSGDA	Ghana Shared Growth and Development Agenda
GSS	Ghana statistical service
Ha	Hectare
HDI	Human Development Index
HH	Household
HHH	Household Head
HPI	Human Poverty Index
ICESCR	International Covenant on Economic, Social and Cultural Rights
IMF	International Monetary Fund
JHS	Junior High School
LBC	Licensed Buying Companies
LEAP	Livelihood Empowerment Against Poverty
MCA	Multiple Correspondence Analysis
MDG	Millennium development goal
METASIP	Medium Term Agriculture Sector Investment Plan
MICS	Multiple Indicator Cluster Survey
MIMIC	Multiple Indicators Multiple Causes
MoFA	Ministry of Food and Agriculture
MPI	Multidimensional Poverty Index
MPI	Global Multidimensional Poverty Index
NSPS	National social Protection strategy
OLS	Ordinary Least Square
OPHI	Oxford Poverty and Human Development initiative
PCA	Principal Component Analysis
PPF	Production Possibility Frontier
PPP	Purchasing Power Parity

PSM	Propensity Score Matching
SAP	Structural Adjustment Programme
SDGs	Sustainable Development Goals
SHS	Senior High School
SPD	Seed Production Division
SRID	Statistics, Research and Information Directorate
TFA	Totally Fuzzy Approach
TFR	Totally Fuzzy and Relative Approach
TV	Television
UDHR	Universal Declaration on Human Rights
UGCC	United Gold Coast Convention
UN	United Nations
UNDP	United Nations Development Programme
UNU-WIDER	United Nations University World Institute for Development Economics Research
VCD	Video Compact Disc
WACRI	West African Cocoa Research Institute

ABSTRACT

Cocoa swollen shoot virus disease has severely hampered the production of cocoa and the economy of Ghana since pre-colonial days. This study set out to find the impact of the cocoa swollen shoot disease on the living standards of cocoa farmers in Ghana.

A structured questionnaire was used to seek information from cocoa farmers in Chorichori in the Sefwi Akontombra District of the Western Region of Ghana where the disease is currently epicenter. All households in the community were interviewed and a total of 84 cocoa farmers' households were extracted. A multidimensional poverty measure, multidimensional poverty index (MPI) is used to measure the standard of living of the cocoa farmers. A Tobit regression model was estimated to find the socioeconomic implication of the disease on the cocoa farmers.

The findings of the study show that cocoa swollen shoot virus disease does not directly have an impact on the living standards of cocoa farmers' households, measured in a multidimensional context. The disease rather has an impact on standards of living through income (household expenditure) of the households. An indication that the incidence of cocoa swollen shoot virus disease affects cocoa production levels by reducing crop yield hence low income that intern lower the living standards of the households. Occupational diversity has a significant impact on multidimensional poverty. Households that diversify have an improved standard of living. Both the Educational level of the household head and Knowledge of CSSVD have a negative effect on MPI and a significant impact on living standards of households. A high level of education and knowledge of CSSDV indicates a high standard of living. Finally, Cocoa Land Size of the cocoa farmers' households has a significant impact on standards of living.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Ghana continues to be a major economy in the world's cocoa (*Theobroma cacao*) industry after being the leading producer of the world's cocoa (*Theobroma cacao*) between 1911 and 1976 (Darkwah and Verter, 2014). It has maintained its position as the second largest producer and exporter of the world's cocoa after Cote D'Ivoire (Schulte-Herbrüggen, 2012). Over the years, Cocoa has been a major cash crop that has economically supported the economy of Ghana. The Western Region alone produces over 60% of Ghana's cocoa. The cocoa farmers in these areas predominantly cultivate mixed Amazon or their siblings (Domfeh *et al*, 2011).

The cocoa sector continues to be afflicted with challenges such as crop damage from pests and disease, declining productivity, health and environmental challenges, child and forced labour on farms and continuous poverty among farming communities (Hainmueller et al., 2011). In recent years, some cocoa farmers in Ghana, especially many who are situated in the northern part of the Western Region (Sefwi) and in the Sefwi Akontombra District have experienced a decline in the rate of cocoa production as shown in Table 1.1 (COCOBOD, 2017). The cocoa swollen shoot virus disease (CSSVD) is seen as a major contributing factor to this challenge. In addition to Ghana, the CSSVD has for several years been the main challenge to cocoa production in other West African countries such as Benin, Liberia, Sierra Leon, Nigeria, Cote D'Ivoire and Togo. Cocoa swollen shoot virus disease is caused by a virus. Symptoms of the diseased trees which occur in the leaves, stem, and roots were first and originally discovered in part of the Eastern Region of Ghana in 1936 (Stevens, 1936). "The disease in its severest types could reduce yield by about 70% as well as

cause the death of the cocoa tree within 2-3 years of infection at all stages of the cocoa growth" (Muller, 2008; Ameyaw, 2014). According to the cocoa swollen shoot virus disease control unit (CSSVDCU) of Ghana, 28,486,309 visibly infected and 'contact' cocoa trees were removed across the country between October 2006 and September 2010. Out of this number, 18,332,234 trees (64.4%) were cut out from the northern part of the Western Region[1] alone whilst the southern part accounted for only 6.1%. The Eastern, Central, and the Ashanti regions of Ghana recorded 10%, 8.8%, and 6.6% respectively. The lowest tree removals took place on the Volta (1.7%) and the Brong Ahafo (2.3%) regions.

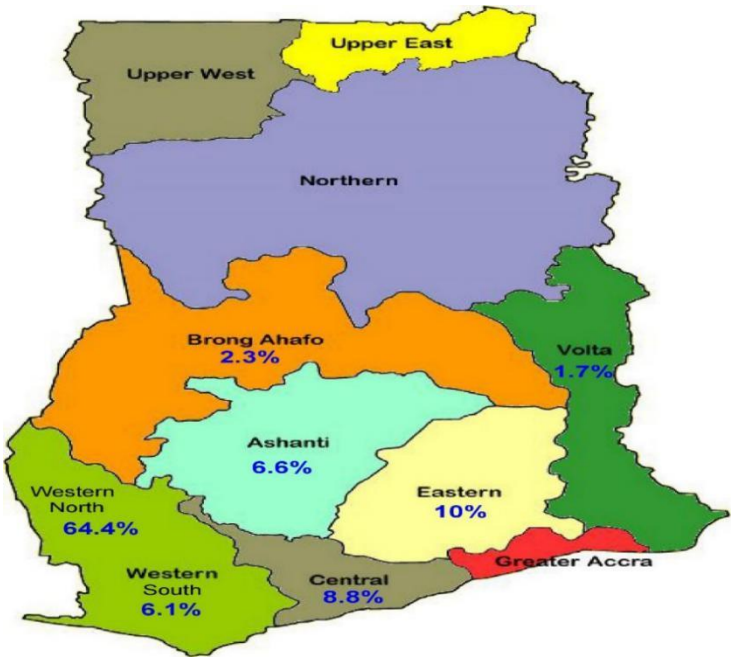


Figure 1.1 Regional CSSVD Cocoa 'Cutting out' Rate

Source: Authors illustration from Domfeh *et al.*, (2011)

[1] For CSSVD control operations, the Western Region has been split into Western North and South.

Goaso and Berekum Districts recorded no swollen shoot infection within this period. However, the highest number of infected that were found and cut out were recorded from Essam and Sefwi Bekwai Districts. The Western North is seen from the current trend to be the epicenter of swollen shoot disease infection in Ghana (Domfeh et al, 2011).

In 2016, statistics on CSSVD in Akontombra District from Ghana COCOBOD, (2017) show that out of 3,029.61 Ha cumulative area of cocoa farm surveyed in complete sectors, 2,588.35 Ha (101 CSSVD cases reported) representing 85.44% share of the total land was affected by CSSVD. It also shows that 2,371,224 and 17,115,378 cocoa trees were affected by the disease in the Akontombra District and Western North respectively. Similarly, the statistics for Western North shows that out of 24,020.07 Ha cumulative area of cocoa surveyed in complete sectors, 10,607.89 Ha (840 CSSVD cases reported) representing 44.16% share of the total land was affected by CSSVD. It is appalling to compare Akontombra District numbers to even that of Western North where the disease is considered to be the epicenter. This has obviously contributed to the current lower rate of cocoa production in the area with records shown in Table 1.1.

Table 1.1 Current Cocoa Productions of Sefwi Akontombra District and Western North

Year	2014/2015	2015/2016	2016/2017 (Main Crop)
Sefwi Akontombra District	12,038.81	12,392.88	11,223.50
Western North Region	192,978.06	202,261.31	224,895.18

Source: Ghana COCOBOD

Moreover, poverty according to Ghana statistical service (GSS, 2014) report on Ghana living standard survey (GLSS) indicates that poverty and for the purpose of this study low living standard is a rural phenomenon. The smallholder cocoa farmers that characterise Ghana and Africa farming

dominate the rural population. Although the poverty incidence in rural forest areas, which include Sefwi Akontombra the study area, is lower than that of the national level, rural areas have a higher incidence of poverty than the national level (GSS, 2014). It is therefore difficult to tell the socioeconomic wellbeing of affected cocoa farmers in the prevalence of this cocoa swollen shoot virus disease. Since the livelihood of farmers depends on their farm output, this effect of the disease on their standard of living need a thorough examination in order to come out with a solution to ameliorate their hardships.

The standard of living has been defined either in its narrow perspective or from a broader perspective by different Economists. The welfarist school of thought which include the World Bank narrow the definition to monetary or material well-being, whilst the capability school of thought broaden the definition to include non-material factors like culture, health, self-respect the enforcement of rights and freedom among others.

A more concise yet policy-relevant definition of a living standard that requires multiple indicators and follows the principles of the capability approach is useful for this research. Such measure of the living standard with a single robust scale enables the impact of various factors (such as household condition, education, health, and assets) to be more readily analysed based on changes in living standards. As a result, multidimensional poverty indicators are adopted to find out the poverty levels of the affected cocoa farmers in the Sefwi Akontombra District. Finding the poverty levels with the multidimensional poverty index accurately tells the living standards of the affected cocoa farmers since indicators such as cooking fuel, toilet, water, electricity, housing condition and assets used in the multidimensional poverty index (MPI) are key factors to achieve the Sustainable Development Goals which are to end poverty in all forms and dimensions by 2030 (UNDP, 2017).

This study, therefore, tries to examine the impact of cocoa swollen shoot virus disease on the living standards of farmers in Chorichori (Sefwi Akontombra District) whose cocoa trees have been attacked and continue to be attacked by the cocoa swollen shoot virus disease. The study also combines various welfare variables depicting the multidimensional nature of poverty levels of affected and non-affected households. Finally, after surveying farmers of Chorichori, the study area, the Tobit regression model is used to estimates the impact of the incidence of CSSVD on the socioeconomic welfare of the cocoa farmer households.

1.2 Statement of the Problem

Cocoa trees in cocoa swollen shoot virus disease (CSSVD) infected areas such as Western North region continues to be attacked leaving cocoa farmers the only option to cut out affected cocoa trees or entire farm and grow again. This has been a disincentive to cocoa farming over the years.

According to Domfeh *et al*., (2011), CSSVDCU of Ghana records show that out of the total visibly infected and 'contact' cocoa trees removed across Ghana, 64.4%, were removed from the northern part of the Western Region alone from 2006 to 2010. Moreover, the highest quantity of infected trees was removed from Essam and Sefwi Bekwai Districts in this same part of the region. Statistics gathered in 2016 on CSSVD in Akontombra District also shows that out of the 3,029.61 Ha cumulative area of cocoa farm surveyed in complete sectors, 85.44% share of the total land was affected by CSSVD. The number of cocoa trees that were affected by the disease in the Akontombra District and Western North were 2,371,224 and 17,115,378 respectively.

Additionally, the survey results from GLSS of the Ghana statistical service show that with the use of new poverty lines and price deflators, there has been a decline in the national poverty rates across the various poverty indices from 1992 to 2013. The country has also met the first Millennium Development Goal (MDG) target of halving poverty between 1990 and 2015, by reducing poverty from 51.7 percent of the population in 1992 to 24.2 percent in 2013. The headcount ratio also fell from 56.5% to 24.2% from 1992 to 2013. Moreover, extreme poverty fell from 33.2% to 8.4% in the same period. Currently, about a quarter of Ghanaians are poor whilst under a tenth of the population is in extreme poverty. The report also shows in GLSS poverty and extreme poverty incidence and gap by locality from 2005/06 to 2012/13 that rural forest areas which include Sefwi Akontombra District have their poverty incidence above the national poverty incidence. However, the contribution to total poverty increased in rural forest areas and a decrease in rural areas. The contributions to the total poverty gap increased for rural forest areas and decreased for rural areas. Similar results were obtained for extreme poverty. Generally, the dynamics of poverty in Ghana over the 7-year period, between GLSS 5 and GLSS 6 (2005/06 to 2012/13), indicates that poverty is still very much a rural phenomenon. Household heads that participated as self-employment in the agricultural sector according to the report had their poverty incidence to be the highest. They contributed the highest to Ghana's poverty. Household heads who are engaged as private employee and self-employment in other sectors other than agriculture are less likely to be poor than otherwise. All these drawbacks are accompanied by the disproportionate welfare distribution of the country.

The cocoa sector significantly contributes to alleviating poverty in the country as well as in rural areas where poverty thrives. The sector benefits households in Ghana either directly or indirectly. The direct benefit goes to groups of people such as cocoa farmer and employees of COCOBOD whose household livelihood depends on the existences of cocoa. Likewise, indirect benefits

include the immense contribution of cocoa to the gross domestic product (GDP) and services provided by an institution established by Ghana COCOBOD such as Cocoa Clinic.

With all these benefits, the cocoa sector continues to suffer from numerous challenges. For instance, farmers in the sector are smallholder farmers who operate on a small scale of fewer than ten acres. Majority of them live in rural areas where poverty is abounded hence characterized by low income, health, and environmental challenges, declining or low productivity, crop damage from pests and diseases, land tenure system, lack of access to finance in addition to comparatively low infrastructure and low standard of living among farming communities (Asamoah, 2013).

Besides these challenges, the cocoa swollen shoot virus disease continues to destroy the cocoa trees of the farmer which serves as the main source of livelihood for these smallholder cocoa farmers. As stated earlier, mass destruction has been made in the northern part of the western region where a larger portion of about 60% of Ghana's cocoa is produced. This poses a serious threat to the country and the farmers in question. Aside from the effects of the disease, one has to cut affected cocoa trees and all their contacts in situations of few attacks. In the situation of mass infection, the cocoa farmer has to clear all the cocoa farm and start anew deepening the already bad experience of the cocoa farmer.

Even though there have been some studies on CSSVD, the several studies by institutions from Ghana, Togo, Cote D'Ivoire and Nigeria focus on the biophysical, biochemical, genomic and biological characterization of CSSVD causal agent. In other words, relatively much research is conducted in the area of virology, epidemiology, molecular biology genetic improvement of cocoa germplasm and CSSV Management; nonetheless, it had been hard to find studies on the impact of this deadly cocoa disease on the socioeconomic well-being of households of affected farmers. Less has been done on the linkage between CSSVD and the living standard situations in affected cocoa

areas. Through a case study from Chorichori in the Sefwi Akontombra District of the Western Region of Ghana, this study seeks to evaluate the impact of the prevalence of cocoa swollen shoot virus disease in cocoa growing areas on the socioeconomic welfare of cocoa farmers in Ghana.

Sefwi Akontombra District is situated in the northern part of the Western Region of Ghana and for that matter, Chorichori is chosen for the case study because the Western North accounted for the highest incidence of infected of the CSSVD Control operations. Again, as high as 85.44% share of the total land surveyed in the Sefwi Akontombra District was affected by the CSSVD in 2016. Moreover, the area can boast of about 75% of its populace employed in the agriculture sector, growing cocoa and food crops (Schulte-Herbruggen, 2011) with a huge number of them being affected by this disease.

From the discussion above, poverty remains a rural phenomenon in Ghana. Sefwi Akontombra District is a cocoa-growing area in addition to the fact that most cocoa growing areas are rural and are faced with the problem of poverty. Apart from this challenge, cocoa trees in these areas continue to be affected by the cocoa swollen shoot virus disease which has worsened their poverty situation. In the prevalence of this disease, one will wish to know the current living standards of these cocoa farmers.

1.3 Research Questions

The questions that need to be answered so as to address the main objectives that the research sought to uncover are:

- What is the current state of the spread of the CSSVD?

- What is the impact of the prevalence of the CSSVD on socioeconomic welfare of the affected cocoa farmers?
- What alternative livelihood strategies have the cocoa farmers adopted as a result of the prevalence of CSSVD?

1.4 Research Objectives

The main objective of this study is to examine the impact of cocoa swollen shoot virus disease on the living standards of the people of Chorichori in the Sefwi Akontombra District.

Specifically, the study aims to:

- determine the extent of the current state of the spread of the CSSVD.
- evaluate the impact of the prevalence of the cocoa swollen shoot virus disease on socioeconomic welfare of the cocoa farmers.
- examine alternative livelihood strategies adopted by the cocoa farmers as a result of the prevalence of CSSVD.

1.5 Significance of the study

Many West African cocoa producing countries including Ghana continue to suffer from the CSSVD. However, a large number of studies conducted on the disease focus on its causes and management with little attention to how it has affected the living standards of the cocoa farmers. Also, much research has not been done on alternative sources of livelihood for the farmers as they

confront the prevalence of CSSVD. This study, therefore, becomes relevant as it attempts to examine the poverty levels as well as find out how these farmers are sustaining their livelihood and eventually suggest policy interventions to ameliorate their plight.

It has been argued that the most appropriate means of measuring living standards for people is to apply the standard of living indicators. This position is confirmed by Fergusson *et al.*, (2001) in the article *living standard of older New Zealanders*. This means it is not appropriate to meet the current research objective of assessing the contributions of diverse factors including income on the living standards of farmers with the use of an income or expenditure-based measure of standard of living. However, this approach is hard to find in the studies reviewed, as the method is comprehensive to measure the impact of the CSSVD on the living standards. In view of the scarcity of this approach in the existing literature, this study adopts the novel approach by utilizing the multidimensional poverty index to examine the relationship between CSSVD and standard of living of cocoa farmers in the study area. The multidimensional poverty index is, therefore, used to evaluate the socioeconomic impact of the disease on cocoa farmers. The use of the multidimensional approach to examining the impact of CSSVD on the living standard of cocoa farmers is a major contribution to the existing literature on the subject.

1.6 Organization of the study

The study is organized into six chapters. Chapter one which is the introductory phase presents the background of the study, statement of the problem, objectives of the study, justification of the study and the scope of the study. Chapter two outlines the overview of cocoa swollen shoot disease and living standards profile of cocoa farmers in Ghana in addition to the relationship between

CSSVD and the living standards of cocoa farmers. Chapter three provides both theoretical and empirical literature on the subject. Chapter four reports the research methodology as well as the data requirement. Chapter five discusses the empirical findings of the study. Finally, the sixth chapter concludes the study and provides directions for policy.

1.7 Scope of the study

The data used for the study was gathered from cocoa farmers in Chorichori of the Sefwi Akontombra District of the Western Region of Ghana. It important to include a large sample of a population in a study, however, this study could not cover a large area due to lack of resources. Resource in the form of finance and time was lacking hence only a community of cocoa farmers in the district where the disease is epicenter was interviewed for the study. The study used a multidimensional poverty measure as a measure for living standards of cocoa farmers. It was hard to choose a specific approach from the numerous approaches available for such a measure. In addition, the arbitrariness in determining a cutoff for the indicators of the Multidimensional Poverty Index that was used for the study aggravated the methodology challenges.

CHAPTER TWO

OVERVIEW OF COCOA SWOLLEN SHOOT DISEASE AND LIVING STANDARDS OF COCOA FARMERS IN GHANA

2.1 The Agriculture Sector in Ghana

In Ghana, the agriculture sector is the main backbone of the economy as is the case of many Sub-Saharan Africans. It has diversely contributed significantly to the living standards of the citizens since colonial days. It is on this note that the authoritative voice of the British government's Colonial Development Corporation posit that Africa provides the most promising field for large-scale development (Klopstock, 1950). Out of the 23,884,245 hectares of Ghana's total land, 13,600,000 representing 57.1% is suitable for agricultural purposes (MoFA, 2016). Ghana's principal agricultural exports are Cocoa, Timber, Horticultural Products and Fish/Sea Foods whereas her principal agricultural imports consist of wheat, rice, frozen chicken, milk, and fish.

Agriculture in Ghana is "largely rain-fed and subsistence-based with rudimentary technology used to produce 80 percent of total output" (FAO, 2015). Majority of farm holdings are below 2 hectares in size. Even though bullock farming is practiced in some places such as the North, the leading system of farming is traditional which includes the hoe and cutlass as tools. Whilst most food crop farms are intercropped, large-scale or commercial farms are a monoculture. Agricultural production depends much on the amount and distribution of rainfall as well as soil factors like texture, nutrient levels, ph. Ghana is classified into five main agro-ecological Zones that are defined on the basis of climate, reflected by the natural vegetation and influenced by the soil. They include Rain Forest, Deciduous Forest, Transitional Zone, Coastal Savannah and Northern Savannah (Guinea and Sudan Savannah). The rainforest zone which covers parts of the western,

Eastern, Ashanti, Brong-Ahafo and Volta regions with plenty rainfall is suitable for cocoa, coffee, oil palm, cashew, rubber, plantain, banana, and citrus. The northern savanna zone is suitable for rice, millet, sorghum, yam, tomatoes, cattle, sheep, goat, cotton and recently mangoes and ostrich. The coastal savannah is notable for vegetables, rice, cassava, maize, sugar cane, mangos, coconut, livestock, sweet potatoes, and soya beans. The climate of Ghana is tropical with two rainy seasons in the south (March to July and from September to October - bimodal rainfall system) and a rainy season in the north (July to September - mono-modal rainfall system) that define the major and the minor seasons. Annual average temperature ranges from 26.1 degrees Celsius in places near the coast to 28.9 degrees Celsius in the extreme north. Agriculture in Ghana is predominantly done in rural areas. The Rural population constitutes 49.1% of the total population in Ghana, however, out of the total of 2,417,800 rural households, 1,820,431 (75.29%) and 72.4% in the Western region engage in agriculture. Again, out of the total of 5,467,136 households in the country, 2,503,006 (45.8%) engage in agriculture. According to GLSS6, the share of the total labour force by the Agriculture sector, which is the largest employer, is 44.7% compared to the service (40.9%) and the industrial (14.4%) sector (GSS, 2010, 2013; MoFA 2016).

The subsistent nature of agriculture in Africa including Ghana in time past was characterized by the wasteful practice called shifting cultivation. Due to this, some economies resorted to cooperative and communal farming as well as public corporations such as paysannat indigene system and the east African peanut project for economic development. These forms of agriculture were meant to allow the use of mechanical equipment and to bring technology into African agriculture (Klopstock, 1950). However, some of these initiatives failed because of inadequate appropriation of technical obstacles in preparing the ground for planting. Other drawbacks included lack of coordination and leadership, administrative confusion, discontent widespread among both the technical staff and the native workers, and turnover of personal correspondingly

high among others. Generally, some complex challenges associated with the agriculture system in Africa characterized by low productivity include the problem of financing, tenure systems, socioeconomics, policy, biophysical constraints, poor storage facilities, inadequate market facilities, and unsustainable land management practices. Klopstock, (1950) posits that highly mechanized projects operated jointly by public corporations and private interests and managed well are much superior to other suggested approaches to the problem of developing the agricultural resource of tropical Africa.

The Agricultural sector employs about half of the national labour force. It employed 55.2%, 54.6%, 54.1% and 53.6% of total labour force in 2007, 2009, 2011 and 2013 respectively (FAO, 2015). Historically, Agriculture has been the dominant sector of Ghana's real economy accounting for an average of over 30% of post-independence GDP. For the moment, there has been a sharp decline in recent year's GDP leading the sector to be the least sector of the economy as of 2016 (Budget Statement of Ghana, 2017).

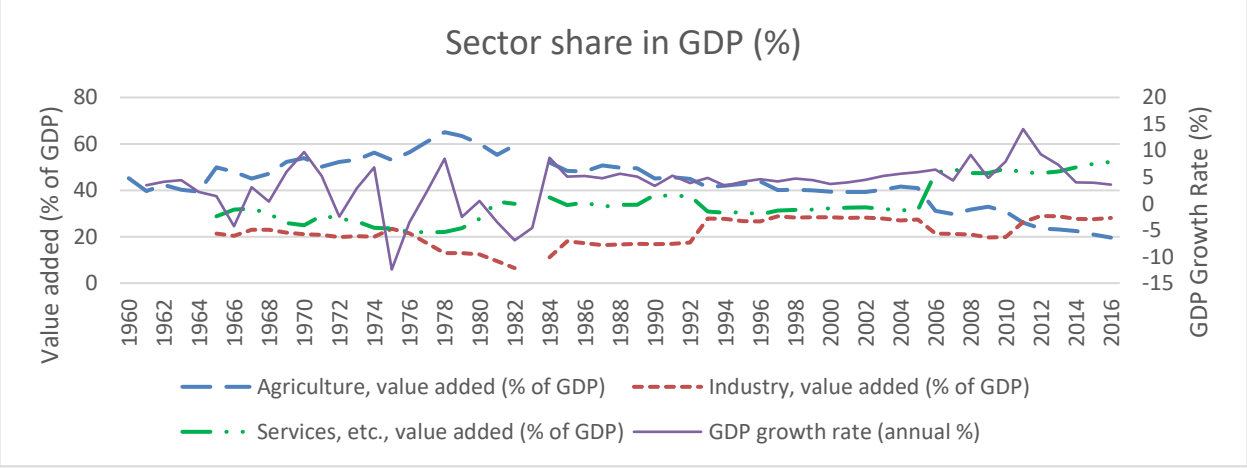
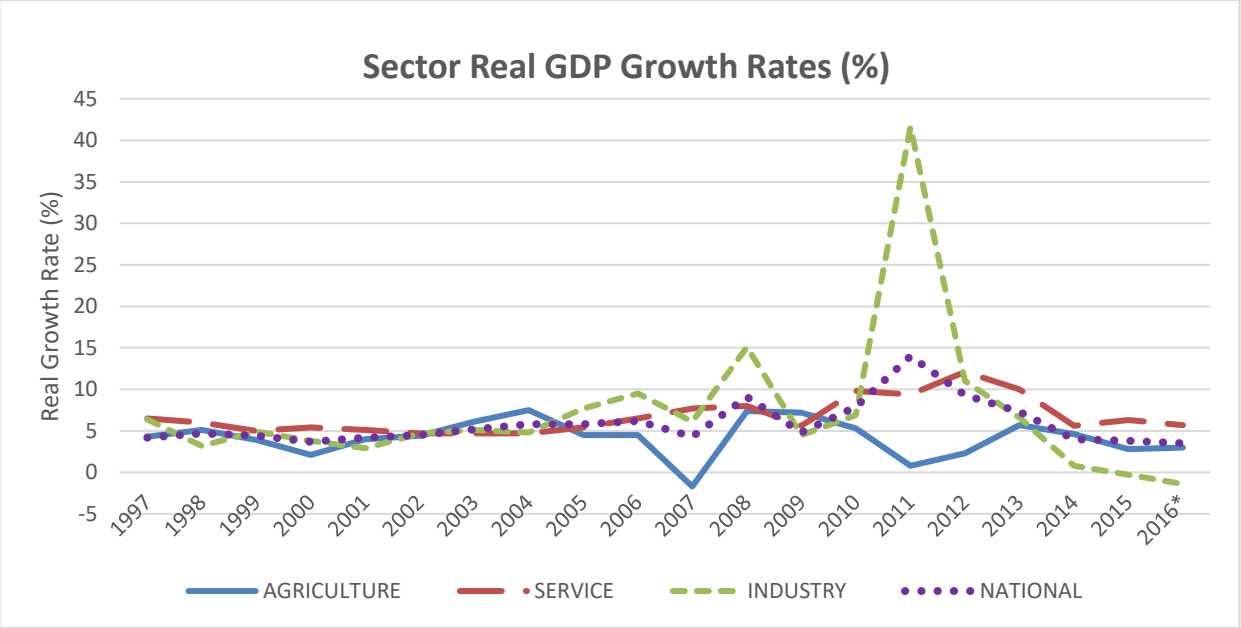


Figure 2.1 Sector Share of GDP in Ghana; *Source: Author's Graph from World Bank Data*

The agriculture sector grew significantly from 2007, gaining from high international prices, mainly for its major exports such as cocoa. Ghana, however, is a net importer of agricultural products.

Consumer-ready commodities such as rice, wheat, sugar, and poultry are mainly imported (FAO, 2015). The Agricultural sector in recent years has been among the least growing sector with a share of 19.3% in 2016 and growth rates declining from 5.7% in 2013 to 2.8% in 2015 (GSS, 2017).

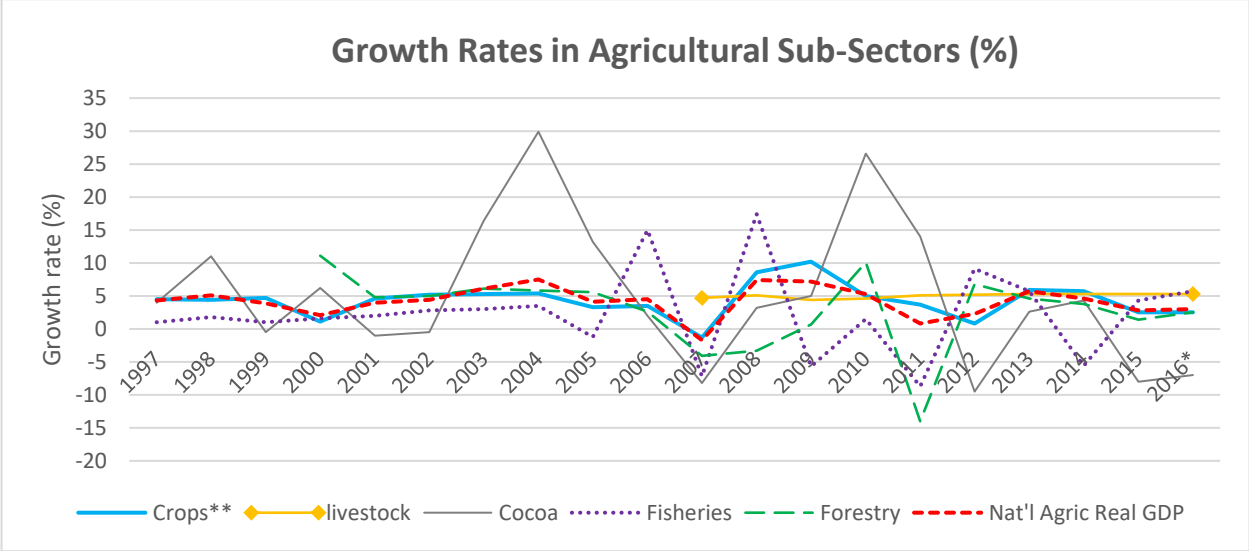


**revised; 2007-2016 Growth Rates were calculated using 2006 constant prices;*

Figure 2.2 Sector Real GDP Growth Rates of Ghana

Source: Author's Graph; GSS, Revised 2016 Annual GDP Bulletin (April 2017); MoFA, SRID, (2011, 2016)

The cocoa sector recorded a growth rate of -8.2%, -9.5%, -8% and a revised growth of -7% in 2007, 2012, 2015 and 2016 respectively compared to 29.9% and 26.6% growth in 2004 and 2010 respectively. Currently, the cocoa sector has the least growth in the agriculture sector. Of all the agriculture activities the Livestock subsector recorded the highest growth of 5.3% in 2015 (GSS, 2017).



*revised ***Crops GDP 1997-2006 refer to Crops/Livestock;*

Figure 2.3 Growth Rates in Agriculture Sub-sectors of Ghana

Source: Author's Graph; Data from (GSS, 2017); MoFA, SRID, (2011, 2016)

2.2 The Cocoa sector of Ghana

Cocoa is a native crop of the Amazon basin in South America (Legg and Owusu, 1976). It was first brought to the then Gold Coast present-day Ghana by the Dutch missionaries in the early years of the nineteenth century (COCOBOD Executive Diary, 2007). In 1879, Tetteh Quarshie of the Gold Coast, returning from Fernando Po - an island in Equatorial Guinea where he had gone to work as a blacksmith - brought with him pods of cocoa. The colonial government of the Gold Coast in the 1930s took over the control of the cocoa industry due to its importance to the economy and the livelihoods of cocoa farmers. This was done through the setting up of a marketing board, the Cocoa Marketing Board now COCOBOD, in 1947, however, it failed to ensure a better price for farmers. Additional institutions such as research and development and quality control were set up to provide service that the board failed to provide. Farmers were provided with subsidies and

inputs like fertilizers and pesticides to enhance their operations. Gold coast became the largest producer of the world's cocoa between 1911 and 1976. The product contributed to about 30-40% of total output. Unfortunately, towards the end of the 1970s, Ghana lost her place as the world largest producer of cocoa because of a fall of world market price by two thirds, which lead to Ghanaian cocoa farmers receiving under 40% of the world market price from COCOBOD. This discouraged many farmers in the cocoa industry. In addition, bushfires and droughts at the beginning of the 1980s made the situation worse. The World Bank and the IMF intervened in 1983 through the Structural Adjustment Programme (SAP) to rescue the economy from collapsing. One of these interventions was liberalizing the cocoa industry by granting private companies the licenses to buy cocoa commodities on behalf of the government (Darkwah, and Verter, 2014).

As a mechanism for paying the realistic price to cocoa farmers, producer price was set solely by COCOBOD till 1984. The Multi-stakeholder Producer Review Committee was then set up by the government in 2001 to set prices after deducting the average cost of production and the industry cost from the net COCOBOD revenue. A net free (or fright) on board (FOB) is then paid to cocoa smallholder farmers (Darkwah and Verter, 2014). Ghana's reputation for high-quality cocoa has been upheld up to date.

2.2.1 Phases of Cocoa Production in Ghana

Kolavalli and Vigneri (2011) discussed the trend of cocoa production in Ghana into four distinct phases: Exponential growth phase (1888 – 1937), Stagnation and post-independence growth phase (1938 – 1964), Downturn phase (1964 -1982) and Recovery and second expansion phase (1983 – 2008)

***Exponential Growth Phase (1888–1937*)**

This is the period cocoa was introduced to the Gold Coast by commercial farmers from the eastern region. The condition of the period encouraged migration of farmers to acquire land for cocoa production, making Ghana the leading producer (1910 -1914). "Ghana exported about 546.72 tons (T) of cocoa in 1900; 2,856.00T in 1905; over 26,520.00T in 1911 and in 1936, she exported 317,220T, representing half the total world production at the time" (Manu, 1989).

Stagnation and Post-independence Growth Phase (1938 – early 1964)

There was a slowdown in cocoa production in this interwar period caused by decreasing demand, growing transportation difficulties, an outbreak of pest and diseases (particularly swollen shoot virus disease). It is believed that the Convention People's Party (CPP) of Osagyefo Dr. Kwame Nkrumah benefitted extremely from favourable postwar market conditions and accumulated massive cocoa income through a sharp rise in market prices in the1950s resulting in farmers being paid twice to thrice the money received before the world war. As a result, production reached an extraordinary level of 430,000 tons between 1957 and 1964. In the 1960s, the world market price fell and farmers were mandated to save 10% of their earnings in a National Development Bond to be redeemed after 10 years. However, the scheme was substituted by a farmers' income tax equal to previous saving deductions. These and many other restrictive measures such as an upsurge in taxes, foreign exchange controls, and comprehensive import licensing, reduction of cocoa producer price to the lowest level, as well as inflation resulting from the printing of money, characterized a crossroads in the fortunes of the CPP government, which was overthrown in February 1966.

Downturn Phase (1964 – 1982)

In late 1964, the world cocoa price collapsed with whopping crop production in West Africa. Ghana alone reached an unprecedented production record of 538,000 tons. Factors stated in the second phase in addition to an increasingly worsening balance of payments situation fueled by worsened macroeconomics, inflation, and exchange rate misalignment triggered the downturn. Other factors are that 20% of Ghana's cocoa was smuggled to Cote d'Ivoire between 1977 and1980, aging tree stock and the spread of disease dropping production to its lowest of 159,000 tons in 1982/1983 representing 17% of the total world volume (reducing from 36% in1964/1965).

Recovery and Second Expansion Phase (1983–2008)

The operation of the Economic Recovery Programme (ERP) with the Cocoa Rehabilitation Project in 1983 brought a turnaround in Ghana's cocoa sector. Other policy changes increased in the farm gate price relative to other countries, devaluing the cedi to reduce the level of implicit taxation of farmers, compensation for removing swollen shoot infected trees and planting new ones, allowing Licensed Buying Companies (LBC) to also procure domestic cocoa in 1992 and COCOBOD staff reduction by 90% between 1992 and 1995. In 2001, other measures such as mass spraying programs, high-tech subsidy packages, application of fertilizer, high world prices, and increased share being passed on to farmers made the cocoa sector more pronounced.

Mass spraying programmes have been found to be effective in increasing cocoa production. The introduction of the programme in the 1960s, when the country was the world number one producer of cocoa, increase cocoa production to as high as over 580,000T in the 1964/1965 crop season. More so, cocoa production rose to 736,975T in 2003/04 cocoa season with the same programme.

Third Expansion and Downturn Phase (After 2008)

Aside from these four phases, the sector reached its highest production volume in 2011 with 1,024,554T (MoFA, 2016). Production levels have not been consistent as it fell after it hit its highest in 2011. This production level in 2011 was achieved probably because interventions in the fourth phase had continued. A reduction in production afterward is attributed to the continuous damage of the cocoa swollen shoot virus disease that was an epicenter in the Western North of the western region where much of Ghana's cocoa is produced. Moreover, many of the interventions by the government such as bearing the cost of removing identified CSSVD infected trees and the labour cost of replanting and managing the cleared farm, education of farmers on good agronomic practices and the payment of compensation to farmers were stopped in 2014.

Table 2.1: The volume of cocoa production from 1997/1998 to 2014/2015 production years.

Year	**1997/98**	**1998/99**	**1999/00**	**2000/01**	**2001/02**	**2002/03**	**2003/04**	**2004/05**	**2005/06**
Cocoa(Mt)	409,383	397,675	436,947	389,772	340,562	496,846	736,975	599,318	740,458
Year	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	***2013/14**	***2014/15**
Cocoa(Mt)	614,532	680,781	710,642	632,037	1,024,554	879,348	835,466	896,220	953,566

*[*revised] Source: COCOBOD; MoFA, 2016*

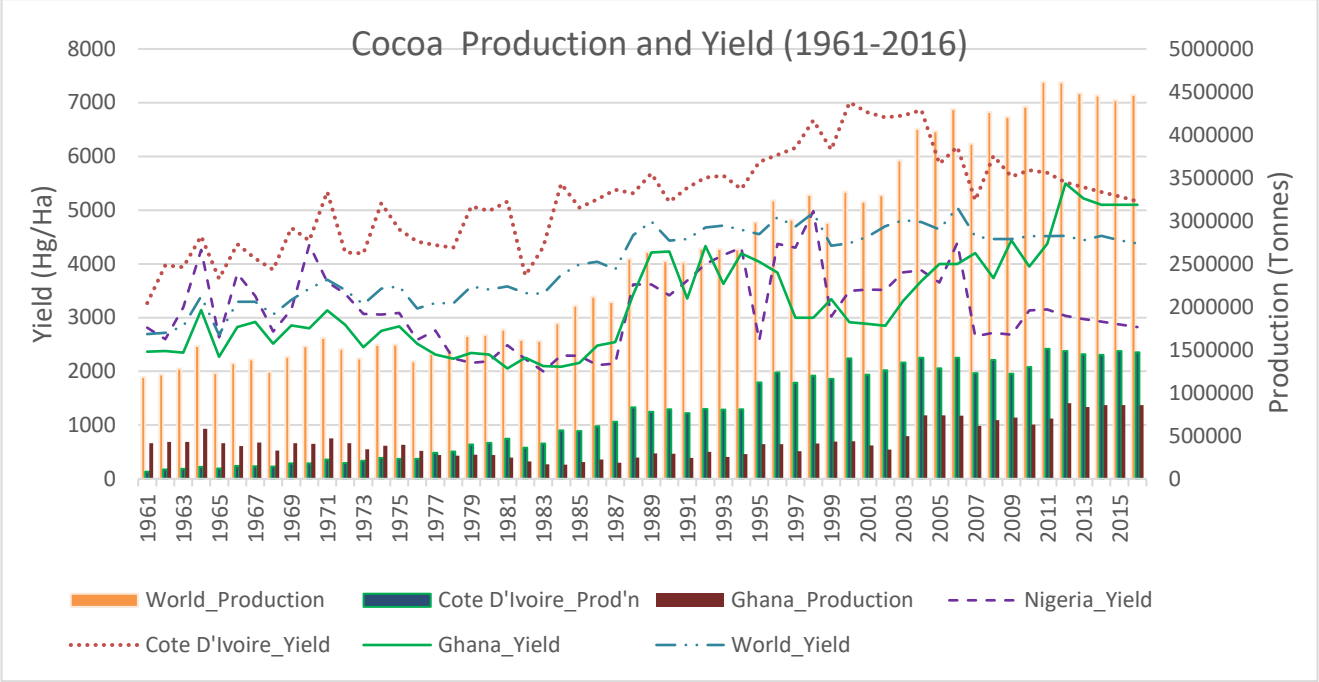


Figure 2.4 Trends of cocoa production and yield since 1961 in selected West African countries

Source: Author's Graph; FAOSTAT Data

The production and yield of Ghana's cocoa have not been stable. Generally, yields of cocoa are lower in Ghana than in other major producing countries such as Cote d'Ivoire. Whilst the average cocoa yield in Malaysia stood at 1800Kgha-1 and 800Kgha-1 in Cote d'Ivoire, it was only 360Kgha-1 in Ghana (Dormon, 2004). Meanwhile, the current trends from 2012 show that Ghana's yield matches Cote d'Ivoire which has a higher yield. The low yield is as a result of the challenges faced by the cocoa industry in Ghana. Such challenges include pest and disease (swollen shoot, black pods, capsid pest among others); access to the best seeds, fertilizers, pesticides, and fungicides as well as the education to apply them properly. Additionally, lack of finance, poverty, climate change and bad weather such as strong harmattan wind, inadequate rainfall; poorly maintained roads networks; an aging farming population. Other factors are weak

currency; untimely or poor resource allocation leading to smuggling; late application of fertilizers, reduction of a government spraying programme among others.

Due to the current low world cocoa price as well as some of these challenges outlined above, the government of Ghana and Cote d'Ivoire signed the "Abidjan Declaration" on cocoa on 26th March, 2018 to address some of the challenges facing the cocoa sector (The Presidency, Republic of Ghana, 2018; Konandi, 2018).

According to Asuming-Brempong *et al.,* (2007), 98% of the workers in Ghana cocoa farms fall within the ages of 18 and 50 years. The cocoa sector employs nearly 50% of the agricultural labour force in Ghana (Seini, 2002). The livelihood of over six million people (25 – 30 percent of the population) relies on the cocoa sector (Anthonio and Aikins, 2009) and the income from cocoa accounts forms more than 67% of household income (Kolavalli and Vigneri, 2011). The cocoa sector as well plays a tremendous role in education via cocoa scholarship; in health via cocoa clinics and in government revenue via a greater contribution to GDP. It is the highest export crop earner in Ghana.

2.3 The Development and Control of CSSVD in Ghana

CSSVD has been found in countries such as Benin, Cote d'Ivoire, Indonesia (Sumatra), Liberia, Malaysia (Sabah), Nigeria, Papua New Guinea, Sierra Leone, Sri Lanka, Togo and in Ghana where 200 million cocoa trees have been destroyed in efforts to manage the disease. There have also been unconfirmed reports about the disease in Trinidad (Ploetz, 2007). Sackey (2000) mentioned reported cases of virus diseases of cocoa "from other parts of the world, including Tanzania

(Zanzibar) in East Africa; Sri Lanka, Sabah Province of Malaysia, Java, and Sumatra in Asia; the Dominican Republic, Costa Rica and Trinidad and Tobago in the Americas". These two reports show that CSSVD is supposed to be a cocoa disease across continents. However, some aspects of the literature limit the disease to Africa and narrow it down to West Africa in particular (Partiot *et al*., 1978; Posnette 1940, 1947).

CSSVD is considered the most economically vital viral disease of cocoa in Ghana (Dzahini-Obiatey *et al*., 2010; Ameyaw *et al.,* 2014). The history of CSSVD can be traced to 1936 when a farmer from Effiduase in the New Juaben District of the Eastern Region of Ghana sent grossly swelled cocoa branches to the District's Division of Agriculture for examination (Danquah, 2003). A field inspection later revealed the symptoms of the disease.

Since cocoa under-girded Ghana's political economy, the control of the CSSV contagion became a meticulous process involving countless laboratory experiments and field trials from 1938 to the 1960s by the central cocoa research station which later turned out to be the West African Cocoa Research Institute (WACRI) in 1944 and now Cocoa Research Institute of Ghana (CRIG) situated at Tafo in the Eastern Region before realistic solutions became feasible (Danquah, 2003).

2.3.1 The Political Economy Perspective of Cocoa Swollen Shoot Virus Disease

Ameyaw *et al.,* (2015) analyzed data on the 'cutting out' programme for CSSVD management in Ghana by giving a historical trend analysis of the total number of cocoa trees yearly removed from cocoa farms from 1936 to 2014. The period of analysis was grouped into five phases with respects to the period of operation and stoppage of the programme.

The first phase dealt with the cutting out of the swollen shoot virus disease trees between 1936 and 1946. A little success in limiting the spread of the CSSVD to infected farms alone lead to a recommendation made in this period to remove trees with visible infections alone, yet this was briefly discontinued in 1937. Shade tree planting replaced this but did not also prevent the spread. In 1943, a national control policy of CSSVD, based on Posnette's (1943) recommendation that "effective control of the disease could be achieved with the removal of visibly infected trees together with a ring of apparently healthy trees that were in contact with the infected trees" was launched in1946. For Danquah (2003), the efficacy of this approach was never in doubt since the virus could not survive for more than 48 hours after the tree's death.

The second phase was the operations of 'cutting out' scheme between 1946 and 1962. After the official lunch of "cutting out" campaign dubbed "compulsion by consent" in 1946, the Department of Agriculture was granted power by the colonial government to compulsorily remove CSSV diseased tree from affected areas followed by a monthly re-inspection (Danquah, 2003). Publicity and education on the benefits of the programme as well as money paid as compensation were used to persuade farmers. In the period 1947 to 1951, for economic reasons, CSSVD served to mobilize both rural and urban populations toward major economic and political upheavals. It became dangerous for the government to destroy infected trees in the postwar period. Again, for economic reasons, the swollen shoot was slowly dissolving the link between the chiefs (that hitherto were the representative of the colonial government to the neglect of the Ghanaian elite dominated by lawyers) and the colonial government and aligning the native rulers and rural populations behind the nationalist politicians. The turmoil of rural and urban unrest enabled Joseph Boakye Kyeretwie Danquah and other city-based politicians to form Ghana's first nationalist party, United Gold Coast Convention (UGCC). The politicization of the CSSV control programs became obviously clear to the Aitken Watson Commission appointed by the British commission to enquire into the

1948 riot. An instance is that J. B. Danquah submitted to the committee that, "the government's policy for the eradication of the CSSV disease was scientifically sound but politically inexpedient." The committee advised the government to invite scientist for an assessment of the swollen shoot eradication but unfortunately, investigators that were invited justified that the elimination of infected trees was the only scientific remedy (Danquah, 2003).

In 1948 the programme was opposed by farmers and suspended. Based on the 1948 Watson and UN Commission reports, the programme restarted but this time concentrated at the area of mass infection (AMI) in 1949. It was in this same year that Kwame Nkrumah, the then Secretary General of the UGCC formed a new political party, the Conventional People's Party (CPP). The frustration of the cocoa-growers with a parliamentary instrument requiring the destruction of their livelihood and stock of capital stood unchanged. The CPP strongly abused this issue for political gains. In 1950, Kwame Nkrumah addressed the Gold Coast Farmers' Association and the Ashanti Farmers Union and strongly condemned the 'cutting out' policy. During the 1950 electioneering campaign, the CPP manifesto explicitly stated that "special attention will be given to the swollen shoot disease". The UGCC manifesto, by contrast, omitted any reference to the vicious cocoa plant disease and farmers in general. The farmer wing of the CPP backed the party to strongly win the election decisively with 34 out of 38 seats. Once in power, however, the nationalist government of the CPP switched to a policy of accommodation and compliance with the scientific methods of Swollen Shoot control which they had opposed for so long (Danquah, 2003).

In 1951, the government appointed a commission chaired by Justice K. Arko Korsah, a Ghanaian jurist, to review the entire matter of swollen shoot eradication and farmers opposition. Many of the farmers fumed their grievance to the Korsah committee[2]. Some of the grievances were that

[2] A deeper explanation has been given in Danquah (2003)

they were not consulted before the compulsory cutting was introduced, the agricultural officers were not well trained to recognize swollen shoot among other complaints. The compulsory cutting out gave way to a voluntary cutting out and treatments were discontinued in the area of mass infection. The compulsory cutting out restarted in the area of mass infection in 1952. As a result of a revision in the grant payment, farmers accepted the cutting out of healthy trees that are in contact with visibly infected trees in 1957. In 1962, the disease was considered to be under control all over Ghana apart from the Eastern Region where spread was concentrated in AMI. Following from this the cocoa division in charge for the campaign was disbanded and individual farmers were asked to voluntarily continue the "cutting out" programme.

During the third phase of the programme (between 1962 and 1964), the farmers who were asked to voluntarily cut out infected trees were reluctant to do so even though a total of 3,788,359 cocoa trees were removed across Ghana. This led to an upsurge and spread of the disease to other areas. The cocoa service division was reinstated in 1964 to continue with the eradication programme.

Plant-as-you-cut scheme was instituted by the cocoa service division in the fourth phase (between 1964 and 1980) to replace the monetary compensation in 1969. The farmers opposed the scheme due to the government promise to restore the monetary payment as compensation. In 1980, this leads to a total suspension of the cutting out scheme.

The final phase of the scheme spans from 1981 to 2011. It began with the third country-wide survey commenced between 1981 and 1995 to assess the incidence of CSSVD. During this period a total of 19,273,309 visibly infected cocoa trees and their direct contacts were cut out across Ghana (Ampofo 1997; Ghana COCOBOD CSSVDCU Technical Report 2004). Phase one of the European Union (EU)-assisted CSSVD control project started in 1994. The aim of the project was to continue treatment by 'cutting out' and rehabilitation through replanting of treated farms in the

already created disease free-belts (cordon sanitaire) in the Eastern and Central Regions. Rehabilitation grants were given as compensation. These control operations were suspended for two years when the EU support ended in1998. The Ghana government in collaboration with the EU sponsored phase two of the programme between 2001 and 2004. This covered the entire country and included the planting of resistant/tolerant varieties. A total of 71,306,366 cocoa trees were removed from 1996 to 2011. As results of the cutting out programme in Ghana, a total of 275,984,959 cocoa trees were removed all over the country between 1945 and 2011.

COCOBOD through CSSVDCU fully financed the "cutting out" and replanting programme in the country from 2007 to 2014. The total numbers of farms treated in only Sefwi Akontombra District and Chorichori from 2011 to 2014 are 1,396 and 21 with the area of 849.85 and 13.37 hectors respectively. During this period, Government supplied cocoa seedlings, borne the labour cost of removal of identified infected trees, educated farmers on good agronomic practices, and paid monetary compensation (ex-gratia) of GHS 547 per Hector to farmers depending on the size of acreage and number of cocoa trees removed. The government in its bid to decrease the cost of implementation of the programme reviewed and presented a new parameter for cutting out policy in 2014 to control the spread of the virus. This new policy shifted the cost of operation of the cutting out programme largely to the farmer. The government only supplied free seedlings and other inputs (fertilizers and pesticides) to the farmers. Table 2.2 shows the total number of seedlings supplied by government and Seed Production Division (SPD) in the Sefwi Akontombra District.

Table 2.2 Total Number of Seedlings Supplied in Sefwi Akontombra District

Year	2012	2013	2014	2015	2016
Government	362,657	155,000	-	1,914,000	1,070,000
SPD	-	325,282	105,000	-	-

Source: Sefwi Akontombra CODAPEC

A total of 91,754 and 71,574 bags of fertilizers were also supplied in 2014 and 2015 respectively. Monetary compensation to the farmer was not paid in addition to all other costs; for instance, the labour cost of replanting and managing cleared farms, and removal of diseased trees were being borne by the farmer (CODAPEC, 2018). In 2018, an official from the Akontombra District office of CODAPEC said the government intends to comprehensively roll out the programme again by including all the interventions that were taken out in 2014.

One main challenge that the CSSVD has brought is that "sharecroppers and tenant farmers could as well suffer ejection from their farms once the cocoa trees are removed if an earlier land tenure agreement does not exclude this clause" (Ameyaw *et al.*, 2014, Dzahini-Obiatey et al., 2010). Royal Landowners in some part of the Western north require the payment of GHS 400 per acre of land before replanting. Although it is not advisable to replant in a CSSVD infected farm since the disease will surely affect the young ones, many farmers are forced by the situation to replant in the already affected farms in order not to lose their land.

Figure 2.5 Growing cocoa seedling among CSSVD infected trees

Source: Author's Illustration

2.4 Living Standards (Poverty) Profile of Ghana and the Study Area (Akontombra District)

The national poverty rates for Ghana show a decline across a number of poverty indices over the period 1992 and 2013.

Table 2.3 Poverty Headcount Ratio and Depth of Ghana

Year	1991/1992	1998/1999	2005/2006	2012/2013
Poverty Headcount Ratio	56.5	43.9	31.9	24.2
Poverty Depth	20.9	15.8	11.0	7.8
Extreme Poverty Headcount Ratio	33.2	24.4	16.5	8.4
Extreme Poverty Depth	9.7	7.4	5.0	2.3

The poverty headcount ratio for the period fell from 56.5 to 43.9, 31.9 and 24.2 percent with the poverty depth declining from 20.9 to 15.8, 11.0 and 7.8 percent for GLSS conducted in 1991/1992, 1998/1999, 2005/2006 and 2012/2013 respectively. Similarly, the extreme poverty headcount ratio also moved from 33.2 to 24.4, 16.5 and 8.4 percent with extreme poverty depth declining from 9.7 to 7.4, 5.0 and 2.3 percent also for the same period. The yearly rate of poverty reduction has slowed for the period. For instance, poverty reduced by an average of 1.8 percentage points per year in the 1990s, whereas a slow average reduction of just 1.1 percentage point per year was realized between 2006 and 2013. However, the rate of reduction of extreme poverty has barely slowed since the 1990s.

Table 2.4: Poverty incidence and poverty gap by locality (%), 2005/2006 - 2012/2013 (Poverty line=GH¢1,314)

Locality	Poverty incidence (P_0)	Contribution to total poverty (C_0)	Poverty gap (P_1)	Contribution to total poverty gap (C_1)	Poverty incidence (P_0)	Contribution to total poverty (C_0)	Poverty gap (P_1)	Contribution to total poverty gap (C_1)
2012/13					***2005/06***			
Accra (GAMA)	3.5	2.2	0.9	1.8	12.0	4.4	3.4	3.7
Urban Coastal	9.9	2.1	2.3	1.5	6.4	1.2	1.3	0.7
Urban Forest	10.1	9.0	2.1	5.8	8.7	4.0	2.2	3.0
Urban Savannah	26.4	8.6	6.6	6.8	30.1	5.1	10.7	5.3
Rural Coastal	30.3	6.9	8.7	6.3	27.2	9.3	6.7	6.7
Rural Forest	27.9	30.1	7.9	26.7	33.1	29.1	8.4	21.4
Rural Savannah	55.0	40.8	22.0	51.1	64.2	46.9	28.0	59.4
Urban	10.6	22.0	2.5	15.9	12.4	39.0	3.7	33.3
Rural	37.9	78.0	13.1	84.1	43.7	136.9	15.4	140.3
All Ghana	24.2	100.0	7.8	100.0	31.9	100.0	11.0	100.0

Source: GSS, 2014

Currently, as seen in Table 2.4, the Ghana Statistical Service's GLSS for poverty incidence and poverty gap by locality (%), from 2005/2006 to 2012/2013 (Poverty line=GH¢1,314) shows that rural forest areas which include Sefwi Akontombra District have their poverty incidence to have decreased from 33.1 to 27.9. Again, the poverty incidence in rural areas decreased from 43.7 to

37.9. These are above the national poverty incidence which decreased from 31.9 to 24.2. However, the contribution to total poverty had an increment from 29.1 to 30.1 in rural forest areas and a decrease of 136.9 to 78.0 in rural areas.

In terms of poverty gaps, there was a decrease from 8.4 to 7.9 in the rural forest above the national poverty gap which decreases from 11.0 to 7.8 and 15.4 to 13.1 in rural areas which are also above the national poverty gap. Contributions to total poverty gap increased from 21.4 to 26.7 for rural forest areas and a decrease from 140.3 to 84.1 for rural areas.

Table 2.5: Extreme Poverty Incidence and Poverty Gap by locality (%), 2005/2006-2012/2013 (Poverty line=GH¢792.05)

Locality	Poverty incidence (P_0)	Contri-bution to total poverty (C_0)	Poverty gap (P_1)	Contri-bution to total poverty gap	Poverty incidence (P_0)	Contri-bution to total poverty (C_0)	Poverty gap (P_1)	Contri-bution to total poverty gap (C_1)
2012/13					***2005/06***			
Accra (GAMA)	0.5	0.9	0.1	0.5	4.5	3.2	1.1	2.5
Urban Coastal	2.0	1.2	0.4	0.9	1.1	0.4	0.1	0.1
Urban Forest	1.8	4.8	0.2	2.1	2.8	2.5	0.8	2.3
Urban Savannah	4.6	4.4	1.0	3.3	16.9	5.5	5.1	5.5
Rural Coastal	9.4	6.2	1.8	4.5	9.6	6.4	1.6	3.4
Rural Forest	7.8	24.2	1.8	20.1	12.6	21.4	2.1	11.9
Rural Savannah	27.3	58.3	8.7	68.5	42.9	60.6	16.0	74.3
Urban	1.9	11.2	0.3	6.9	5.1	11.6	1.4	10.4
Rural	15.0	88.8	4.3	93.1	23.4	88.4	7.2	89.6
All Ghana	8.4	100.0	2.3	100.0	16.5	100.0	5.0	100.0

Source: GSS, 2014

Additionally, the Ghana Statistical Service's GLSS for extreme poverty incidence and poverty gap by locality (%), from 2005/2006 to 2012/2013 (Poverty line=GH¢792.05) shows that rural forest saw poverty incidence to have decreased from 12.6 to 7.8, below the national poverty incidence which decreases from 16.5 to 8.4. The poverty incidence in rural areas also decreased from 23.4 to 15.4. This is above the national poverty incidence. The contribution to total poverty had an increment from 21.4 to 24.2 in rural forest areas and an increment of 88.4 to 88.8 in rural areas.

In terms of poverty gaps, there was a decrease from 2.1 to 1.8 in a rural forest, below the national poverty gap which decreases from 5.0 to 2.3 and 7.2 to 4.3 in rural areas, above the national poverty gap. Contributions to total poverty gap increased from 11.9 to 20.1 in rural forest areas and a decrease from 89.6 to 93.1 in rural areas.

The report also indicates that household heads who are engaged as self-employed in the agricultural sector have their households to be among the highest poverty incidence. These household heads contribute the most to Ghana's poverty. Household heads who are engaged in non-agriculture sectors are less likely to be poor than those engaged in the agriculture sector. It also indicates that welfare distribution is more lopsided in Ghana at the time of the survey (2012/13) than in 2005/06; there is rising inequality as measured by the Gini coefficient (GSS, 2014)

Since 2006, the fraction of poor people has reduced by a quarter. Likewise, the number of people living in poverty has only reduced by about 10%. The percentage of individuals living in poverty reduced from 31.9% in 2005/2006 to24.2 in 2012/2013, whereas there was a decline from 7 million to 6.4 million in the number of individuals living in poverty. This is an indication that poverty reduction is not keeping up with population growth. Correspondingly, there was a reduction from 16.5% in 2005/2006 to 8.4% in 2012/2013 in the percentage of individuals living in extreme poverty (individuals incapable of meeting their basic food needs. This also represents a reduction from 3.6 million to 2.2 million (GSS, 2014).

The decomposition of poverty in Ghana showed that male-headed households had higher poverty rates (25.9%) than the female-headed households (19.1%) in 2013. Similarly, Households in rural areas had on average a much higher poverty rate (37.9%) compared to the households in urban areas (10.6%) in 2013. The regions in Ghana that have the highest poverty rates include the

Northern, Upper East, and Upper West. Greater Accra region has the least number of poor people of 241,166, whilst the Northern region has the largest population of the poor of 1.3 million in the country. The year 2013 results disclose that 28.3% of children are poor (3.65 million) and children who live in extreme poverty are about a tenth. This represents around 1.2 million children. Regardless of the achievement in decreasing poverty, all indices demonstrate that inequality has risen from 1992 to 2013 (Kwarase, 2017).

Infrastructure, education, and health are some of the areas in the economy where advance has been made. These undoubtedly reveal the gains made in decreasing poverty amongst innumerable population subgroups, for instance, the educated (GSS, 2014).

2.5 National strategies to reduce poverty

The government of Ghana continues to elicit strategies to improve upon the living standards of farmers and to reduce the poverty level of Ghanaians in general. Recent and colonial governments have rolled out development plans that sought to better the life of Ghanaians. Such plans are as shown in Table 2.6 below:

Table 2.6 Poverty Reduction Strategies/Plans for Ghana

Date	Strategy/Plan
1920-1930 (1919)	The first Seven-Year Dev. Plan (Governor Gordon Guggisberg)
1930-1940	Second Ten-Year Plan
1946-1956	Third Ten-Year Plan
1951-1961	Fourth Ten-Year Plan
1951-1956	Five-Year Plan
1958-1959	Consolidation Plan
1959-1964	Second Five-Year Plan
1963/64-1969/70	Seven-Year Plan - "Work And Happiness"
1967/68-1968/69	Two-Year Development Plan - "The Stabilisation Plan"
1971-1972	Rural Development Plan
1975/76-1979/80	Third Five-Year Plan
1981-1986	Fourth Five-Year Plan
1996-2020; Phase 1: 1996-2000	Ghana's Vision 2020 (National Development Agenda)
2003 – 2005 & 2006 – 2009	Ghana Poverty Reduction Strategy (GPRS) I & II
2010 – 2013	Ghana Shared Growth and Development Agenda (GSGDA I)
2014 – 2017	Ghana Shared Growth and Development Agenda (GSGDA II)

Source: Author's compilation from National Dev. Planning Commission (Owusu-Amoah, 2018).

The government of Ghana propelled the Economic Recovery Programme (ERP) under the direction of the World Bank and the IMF in 1983 with the aim to reduce Ghana's debts and to enhance its trading position in the world economy. Again in 1984, the Structural Adjustment Programme (SAP) with the principal goal of decreasing its involvement in the economy and permitting the free interaction of demand and supply was also launched.

In the agricultural sector, several policy interventions to achieve objectives of the sector, food, and nutrition security have been put in place for improved livelihood. Among them are the Food and

Agriculture Sector Development Policy (FASDEP II, 2007), the Medium Term Agriculture Sector Investment Plan (METASIP, 2010-2015) and the National Social Protection Strategy (NSPS, 2008).

According to the FAO (2015) report on food and agriculture policy trends in Ghana, the government key policy decisions from 2007 to 2014 are discussed below.

***Producer-oriented policy decisions*:** These are programmes executed by MOFA at national level that encompass the re-introduction of input subsidies like the national Fertilizer Subsidy Programme in 2008; Launch and expansion of mechanization services like the 'Agriculture Mechanization Services Enterprises Centres' (AMSECs) programme in 2007 to serve as a credit facility, supporting qualified private sector companies in purchasing agricultural machinery at a subsidized price and interest rate which in turn is hired to rural farmers at reasonable prices.. To Complement the AMSECs, the 'Block Farm Programme,' was propelled in 2009 as a component of the Youth in Agriculture Programme; the establishment of national buffer stocks and minimum guaranteed prices for farmers in 2010, with the intention of decreasing post-harvest losses, ensuring price stability and establishing emergency grain reserves; to make an efforts to increase access to agricultural finance, the government instituted a Collateral Registry on February 2011 via the Central Bank to subsidize and charge low fees to its users; and the Irrigation Development Programme.

***Consumer-oriented policy decisions*:** This kind of policy focuses much on cash transfer programmes to enhance education, health in addition to alleviating poverty. They include the establishment and expansion of the Conditional Cash Transfer (CCT) programme (The Livelihood Empowerment Against Poverty (LEAP)) in 2008 to provide cash and free health insurance to extremely poor households; scaling up of the School Feeding Programme (Ghana's School

Feeding Programme (GSFP)) established in 2005; and resolving challenges in reforming fuel subsidies since the early 2000s to limit extreme fiscal costs and to enhance the general efficiency and effectiveness of public spending.

***Trade- and market-oriented policy decisions*:** Policies to attain the objectives of Ghana's trade covers the regional integration which was debilitated after the 2007/2008 worldwide food price crisis when a wide range of taxes and fees were applied on imports from ECOWAS countries; the tariffs briefly lifted during the 2007/2008 global food price crisis in 2008; the sustained export promotion policy implemented through the 'Ghana Export Promotion Authority' (GEPA), instituted in 1969, and the 'Ghana Export Trade Information Centre' (GETIC), in 2005 as well as the National Export Strategy for the Non-Traditional Export Sector (2012-2016) and the National Export Development Programme (2013) to offer guidelines for the execution of Ghana's domestic and international trade agenda; the development of the first agricultural insurance programme (Ghana Agricultural Insurance Programme (GAIP)) through public-private partnership in 2011 to safeguard farmers against financial risks resulting from climate change.

CHAPTER THREE

LITERATURE REVIEW

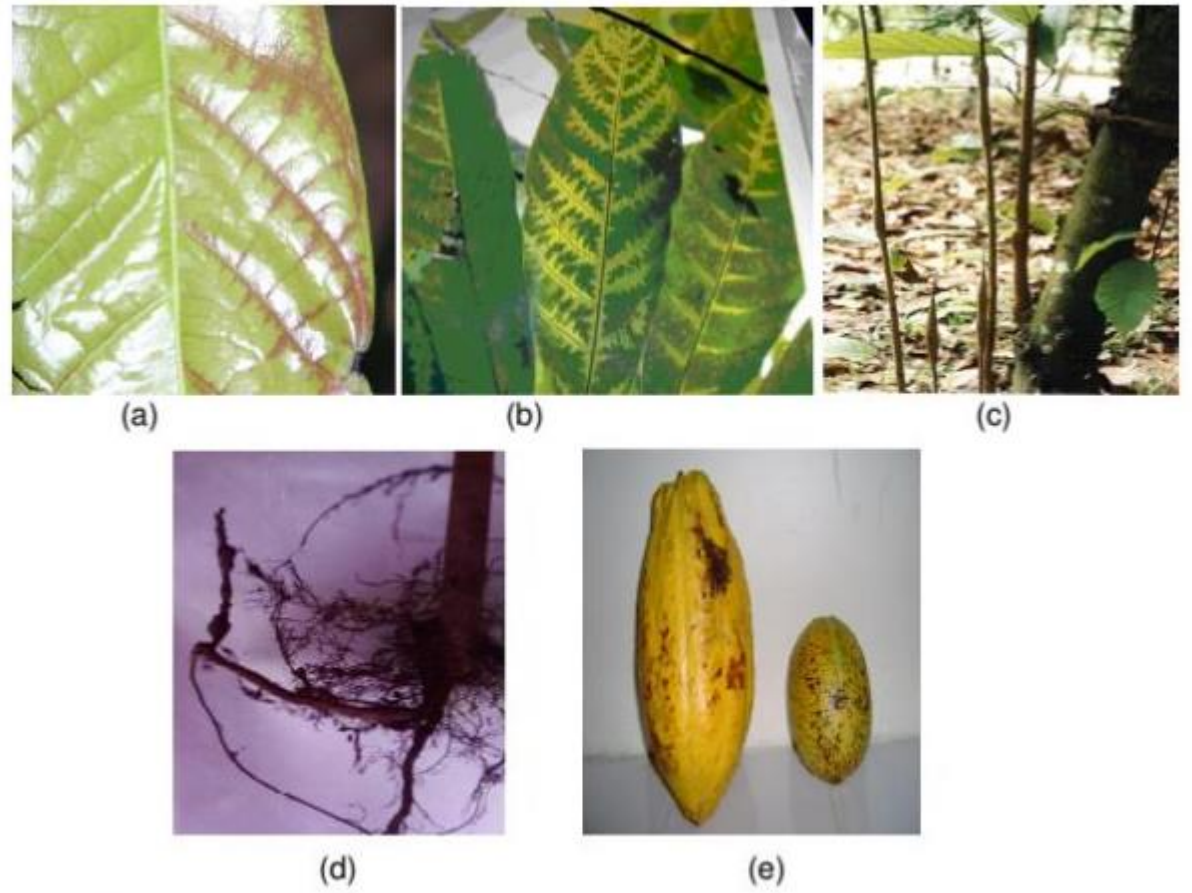
This chapter will provide a review of relevant literature on the subject from theoretical, conceptual and empirical perspectives as follow.

3.1 Meaning and Scope of Cocoa Swollen Shoot Virus Disease

The cocoa swollen shoot virus disease like any other disease like pink disease or Phytophthora pod rot significantly affects the crop yield and pod production. Pest and diseases in cocoa production are considered to be the worldwide threat that overshadows all other challenges (Akrofi *et al*., 2014). Farmers normally identify the signs and symptoms of a new cocoa disease but may not know the type, cause, prevention or management of an outbreak of the disease. The CSSVD is of no exception to other cocoa diseases.

Cocoa swollen shoot virus (CSSV) is defined by Obok *et al*. (2014) as "a debilitating mealybug-borne pathogen affecting cocoa production in West Africa". Even though the disease was initially recorded in the Eastern Region of Ghana in1936 (Steven, 1936), Paine (1945) claims the disease had already been observed in 1922. A virus (bacilliform DNA virus) causes the cocoa swollen shoot virus disease (Ameyaw, 2014). This virus has its place in the viral family of Caulimoviridae and genus Badnavirus (Lot et al., 1991). It transmits via the feeding action of numerous mealybug species (Ameyaw, 2014). The symptoms of the disease include red vain-banding occurring in young leaves, then clearing or chlorosis along the veins, stem and roots swellings, yield reduction, dieback and complete death of affected plants, distortion in pod shape and size, occasionally with

green mottling, the pod turn out to be round and at times almost spherical (Posnette, 1941, 1943; 1947).



Some symptoms of CSSVD. (a) Red vein-banding in a young leaf (b) Chlorotic vein clearing in mature leaves (c) Swellings in chupons (d) Root swelling induced by CSSV. (e) Distortion in pod shape and size. Two pods of comparable age, note rounded shape, reduction in size and smooth surface of the one on the right (infected).

Figure 3.1 Symptoms of CSSVD

Source: Domfeh, (2011)

In West African cocoa-growing countries, this pathogen endemic is thought to be transmitted by at least 15 mealybug species both via short distance movements between contacting tree canopies (radial spread) and longer distance by 'jump spread' of windborne vectors into a replanted area (Roivainen, 1980; Obok 2014; Jeger and Thresh, 1993). Studies show that western Ghana strains

of CSSV may have initiated from forest trees. Therefore "in Ghana, the pathogen or virus was also isolated from alternative host trees such as *Cola chlamydanta, Ceiba pentandra, Adansonia digitata, Cola gigantean and Sterculia tragacantha"* (Dzahini-Obiatey *et al*., 2010).

According to Muller (2016), CSSVD only occurs in West African countries such as Ghana, Nigeria, Cote D'Ivoire, Sierra Leone, and Togo where there have been reports of the disease. Thresh *et al*. (1988), however, posit that "the virus may also occur elsewhere because mealybug-transmitted pathogen of cocoa that cause leaf symptoms and sometimes swellings resembling those of swollen have been reported in Java, North Sumatra, Sri Lanka, and Trinidad".

An infected healthy cocoa tree may not exhibit any symptoms for a substantial period. It is important to note that the effect of the disease on infected cocoa trees is made intense under unfavorable conditions. For instance, Thresh (1959) through observation posited that, effects of virus infection in cocoa are considerably influenced by other diseases and pests as well as the environment, hence strains of the swollen shoot viruses in Nigeria had lethal effects only when the infected trees were also attacked by capsids and fungi and growing under unfavorable condition. Osei (2000) added that the "latent period varies according to the type of strain of the virus, the age and condition of the tree". Due to the disease's latent nature of spread Thresh et al. (1988) describe the disease as an archetypal crowed disease. The virulent strains may produce severe symptoms within five months on sensitive Amelonado; an indication that the virus severely attacks the Amelonado than other varieties such as the Upper Amazon, but the mild strains may not show themselves for two years more (Wood and Lass, 1985). Moreover; the Amazon varieties were so promising that breeding for resistance can decrease the percentage of spread by up to 20% but six decades after the detection of this potential and its deployment, the CSSV disease continues to spread at an increasing rate (Padi *et al*., 2013; Posnette, 1981).

Genetically the CSSV is assorted and it is associated with various strains that cause diverse symptoms. A large portion of the symptoms are one of a kind to various strains and the symptom expressed relies on the host (Dzahini-Obiatey et al., 2010). Interestingly in Ghana, CSSVD types (strains/isolates/separates) are named based on the closest town or village where the virus was originally gathered and assembled by the sternness of symptom appearance as well as the geographical source. Seventy-seven strains of the virus are known in Ghana over the cocoa regions in view of the variation of symptoms (Sagemann *et al*., 1985). **"**The viral types are further categorised into severe, mild and intermediate strains based on types of symptoms induced in the host plant" (Posnette, 1947).

Management, treatment and preventive control measures of the disease has been done via cutting out (eradication) of visibly infected trees and their contacts; clearing and replanting extensive area where large outbreaks occur (Thresh and Owusu, 1986); removing alternative host tree; diversification such as barrier (strip) cropping and shading or agroforestry; breading and mild cross protection; screening method for resistance breeding such as antiviral substance, somatic embryogenesis; and vector control Insecticide (Andre *et al*., 2017). Out of this numerous measure, the cutting out (eradication) method is considered to be the most effective cure for CSSVD (Andre *et al*., 2017).

3.2 Concept, Definitions, and Measurements of Living Standards

Pigou uses 'the standard of living', 'economic welfare', 'standard of real income' and 'material prosperity' as more or less synonymous (examples are found in Pigou (1952)) (Sen, 1984). In the same view "standard of living" and "living standards" will synonymously be used in this study.

The standard of living has been defined differently by many Economists. The World Bank and Perry, (2009) are few that define it in its narrowed perspective whilst others such as Sen, (1993), article 11 of the International Covenant on Economic, Social and Cultural Rights (ICESCR), and article 25 of the Universal Declaration of Human Rights (UDHR) of the United Nations consider it on a broader base.

These definitions rest on the various schools of thought about poverty which are the welfarist, the basic needs and the capability schools of thought (Ifelunini, 2013). The welfarist school addresses the standard of living or economic welfare/well-being in the form of the total consumption level determining utility. One main definition adopted by the welfarist school is that "poverty can be said to exist in a given society when one or more persons do not attain a level of well-being deemed to constitute a reasonable minimum by the standards of that society". This approach, which defines the standard of living in its narrower sense, limits the definitions to money-metric and material aspects of living standards such as level of income, whether one owns an item among others. The welfarist school is being promoted by an institution like the World Bank. For Perry (2009), “a country’s living standard is determined with reference to material living conditions - things that money can buy - and no more”. GDP, in this case, is used as a proxy for living standards.

The basic needs approach is the second school that addresses the standard of living in the form of a subset of goods and services explicitly identified and believed to meet the basic needs of all human beings. These basic needs include shelter, food, water, basic education, health service, public transportation, and clothing. Basic needs in this sense are seen to be a pre-requisite for the high quality of life.

The capability approach pioneered by Amartya Sen is the third school of thought. This approach discards the measure of well-being with monetary income and focuses on indicators of the freedom

to live a valued life or realise human potential. Unlike the welfarist, the capability school defines poverty as "failure to achieve certain minimal or basic capabilities". That is the failure of some basic capacity to function. On the other hand, 'basic capacities' is "the ability to satisfy certain crucially important functionings up to certain minimally adequate levels" (Sen 1993). This school defines the standard of living in its broad sense. The capability approach shifts from monetary indicators and emphasis on non-monetary indicators for examining welfare since the differences that people face in converting monetary resources into valuable achievements (functionings) depends on diverse individual characteristics. Hence monetary resource may not be a reliable attribute of capability outcome. The approach, therefore, places emphasis on the notion of the adequacy of monetary and other resources for the functioning of certain capabilities than they being sufficient. The definitions in line with this approach "describe the psychological and wider social aspects of a person's well-being such as quality of life and social inclusion (for example, participation in democratic processes) as well as material conditions and consumption" (Erikson and Aberg, 1987; Statistics Sweden, 1996; Australian Bureau of Statistics, 1998). Additionally, article 25 of the *Universal Declaration on Human Rights* (UDHR), "describes an adequate standard of living as including adequate food, clothing, housing, medical care, necessary social services and the right to security in indigent circumstances". Article 11 of the *International Covenant on Economic, Social and Cultural Rights* (ICESCR) employs a similar definition. Studies which adopt these definitions emphasis on numerous areas of concern measured through multiple indexes (Fergusson *et al.*, 2001).

Pigou (1952) distinguishes a generic standard of living and economic standard of living. Pigou (1952) similarly defined economic welfare as "that part of social welfare which can be brought directly or indirectly into relation with the measuring rod of money" and so social or overall welfare becomes the generic standard of living. Sen (1984), commenting on Pigou's position said,

“economic welfare' is an interesting concept of its own, which relates to but is not necessarily one separable part of welfare or utility or happiness”. In relation to this, it has also been pointed out that the definition selected will be influenced by what one wants to measure in addition to goals to be attained (Tam, 2013).

In measuring standards of living, Fergusson *et al.*, (2001), indicates that recent research aims to describe the wide range of material conditions and consumption. This means an income or expenditure-based measure of living standards, such as the use of poverty line, consumption, income (GDP, GNP, Real GDP, and Real GNP), is not appropriate to meet the present research objective of assessing the contribution that different factors make to variation in living standards of people. In this manner, the most apposite means of measuring living standards is to utilise the standard of living indicator approach. Examples of such approach include human development index, multidimensional poverty index, human poverty index, happy planet index, Genuine Progress Indicator, Index of Social Health. Fergusson *et al.*, (2001) further drew from earlier studies, workshop discussions, and consultation with Maori researchers and found out that “living standards indicators were developed to represent the full range of living standards and included the use of deprivation items commonly used in studies assessing poverty to gain information about the lower end of the spectrum of living standards”. The indicators that have been produced for the development of a scale for this study, therefore, include questions about household’s education, health, and standard of living indicators such as housing conditions, household asset, lighting, cooking fuel, water supply, toilet facility.

3.3 The link between CSSVD and living standards of Cocoa Farmers

The cocoa industry contributes significantly to the socio-economic wellbeing of Ghanaians. People who do not directly participate in the cocoa industry benefit one way or the other. For instance, the cocoa subsector contributed 3.6% to the GDP of Ghana in 2011 (Ghana Statistical Service, 2015). Again, aside the many social responsibilities and services like scholarships, donations, maintenance of roads and provision of solar lights to farming communities provided by Ghana Cocoa Board (COCOBOD), exports and duties that were paid into government coffers in 2011 was GHC 153,933,253. It also supports over 80,000 families of farmers and others such as COCOBOD and affiliate staff (COCOBOD, 1998, 2011; Asamoah *et al*., 2013).

Unfortunately, the majority of farmers in the cocoa industry work on small-scale, spread within the seven cocoa regions in Ghana. These farmers who typically live in rural areas are characterized by low income, lack of access to finance, declining or low productivity of under 400 kg/ha for low technology farmers and 650 kg/ha for medium technology farmers (CRIG, 2012), high illiteracy, crop damage from pests and disease, health and environmental challenges, instances of child and forced labour on farms and comparatively low standard of living or persistent poverty among farming communities (Hainmueller *et al*. 2011; Asamoah *et al*., 2013). According to GSS (1995), "poverty is disproportionately concentrated among certain groups of the population and that geographically, rural areas are affected by higher levels of poverty than urban areas. Again, within socio-economic groups, farming households, especially food crop farmers, are most likely to be poorer and with poor access to social and economic amenities and other infrastructure" (GSS Report, 2007; Asamoah *et al*., 2013). Fortunately, GLSS 1, 5 and 6 reports show that poverty is said to have diminished significantly from 51.7% in 1991 to 28.5% in 2005 and a further reduction to 24.2% in 2013.

Apart from all these challenges, "the Cocoa swollen shoot virus disease has plagued cocoa production in West Africa for more than eight decades" (Dzahini-Obiatey *et al*., 2010). High standard of living requires a number of goods and services produced and available to be purchased (Amadeo, 2017). However, the CSSVD continues to destroy the farms from which cocoa farmers, especially those in Western North, generate their income. Following from this, the Essam district with nearly 29,000 hectares has been designated as an Area of Mass Infection (AMI) by COCOBOD (CSSVDCU, 2007). This poses a major threat to the Ghanaian economy because the western region alone produces over 60% of Ghana's cocoa (Annon, 2010).

The compulsory removal of CSSV diseased trees from affected areas by the Department of Agriculture through the 'cutting out' campaign formally launched in 1946 (Ameyaw, 2015) has been considered as the most determined and expensive eradication campaign to curtail a plant viral disease anyplace in the world (Thresh *et al*., 1988a). "Ghana colonial department of agriculture destroyed 81,000 cocoa trees on 300 farms between 1936 and 1937" (Danquah, 2003). Owusu and Thresh (1983) mentioned that at the beginning of the cutting out campaign in 1956, over a million affected and contact trees were removed. By 1982, it was estimated that 185.5 million trees had already been removed in the Eastern Region alone and there were still 31.2 million trees to be removed (Osei 2000). Domfeh (2011) also pointed out that "By September 2010, 247,690.03 ha of the cocoa area had been surveyed in the Western North Region, revealing a total of 4,186 swollen shoot disease outbreaks with an estimate of 43,884,435 trees involved. Out of the number, 756 outbreaks were completely treated (cut-out or removed), leaving 3,430 outbreaks with an estimate of 38,336,827 trees outstanding by September 2010". Over 200 million trees are estimated to have been claimed by the disease leading to a huge loss in monetary terms of the dead of the cocoa trees (Ollennu *et al*., 1989a, 1999; Dzahini-Obiatey, 1993, 2008). Other social factors, for example, land tenure security and perceived loss of livelihood through the elimination of

infected trees have made it problematic for farmers to completely acknowledge the programme as the best disease control method (Thresh *et al*., 1988; Dzahini-Obiatey *et al*., 2010; Ameyaw *et al*., 2014)

Dzahini-Obiatey *et al*., (2010) tried to identify some ways through which income is lost as a result of CSSVD thereby leading to cutting out affected trees and their contacts. For them, the loss of income impacts negatively on government through loses in tax revenue from cocoa, which could have been applied for developmental projects. Likewise, the effect on the peasant cocoa farmers is even more overwhelming since a complete farm could be lost to the disease leading to the curtailment of their regular source of income. In the most pessimistic scenario, settler farmers could lose their land to their landlords once they clear the cocoa.

3.4 Indices of Household Poverty

3.4.1 Unidimensional Poverty Index

The traditional (income/expenditure/consumption/money-metric) approach to deprivation (poverty) measurement reflects only one dimension (unidimensional approach) of measuring poverty. This is because restricting the multidimensional poverty index to only one dimension such as health, education, income among others produces a unidimensional index. For instance, from the fuzzy set framework, a unidimensional poverty ratio for each of the *j* attributes can be obtained (Costa and Angelis, 2008). However, the income dimension has widely been used for poverty analysis. Since only one aspect of human welfare is insufficient in determining the

standard of living, it is prudent for researchers to include all the necessary aspects of life that will best capture the characteristics of human happiness, welfare or comfort.

Concerning the traditional money-metric poverty measure that follows the welfarist viewpoint as well as takes the utilitarian approach to conceptualize welfare, Gangopadhyay, (2015) pointed out several limitations from critics.

First, in real life situations, three of the basic assumptions of the money-metric approach, which are all goods and services that constitute overall welfare, are constantly available and marketable; all individuals have the same preferences and maximization motives and all individual face the same price and accessibility, are flawed. Secondly, it fails to capture welfare derived from public goods and services, non-market goods, home production, and in-kind transfers (Kuklys, 2005). Thirdly, by generally measuring income at the household level, the differences in the household composition, household needs, and intra-household distribution are ignored. Moreover, it fails to capture the actual level of individual welfare. In the fourth place, Sen (1984, 1993, and 1999) posit that the money-metric approach is a resource-based evaluation hence, it fails to address the individual heterogeneity and interpersonal differences in abilities that convert income (the resource) into welfare (the outcome). Lastly, Kolm (1977) observed that there is a violation of the symmetry axiom of welfare analysis due to the failure of the money-metric method to capture important interpersonal differences that affect individual welfare. These and many other criticisms have led to the adoption of the multidimensional poverty measure by poverty researchers.

3.4.2 Multidimensional Poverty Index

In view of the limitations of the unidimensional index, the multidimensional poverty index technique to evaluate the standard of living was developed. It combines the monetary and non-monetary measures simultaneously. Many scholars have argued that standard of living in view of poverty deprivation is a multidimensional concept and not a unidimensional (Kolm, (1977), Sen (1999), and Atkinson (2003)). Aggregation of the multidimensional index can be done at the micro (individual/household) level (Townsend 1979) as well as the macro level (Anand and Sen, 1997; Betti and Verma, 2007).

Poverty has dominantly been an economic concept and its identification was statistically done solely on the basis of household income or expenditure, adjusted to family size, relative to a specified income poverty threshold until the 1970s (Costa and Angelis, 2008; Afenso *et al.*, 2015). The introduction of 'basic needs' approach in the mid-1970s, social exclusion and capability approach called for a review of the single income or expenditure measure to supplement a multidimensional measure. This is because "since the 1980s, studies have shown that income does not correctly proxy non-monetary deprivations for identifying the poor" (Afenso *et al.*, 2015).

This multidimensional concept of poverty measurement is predominantly used by the UNDP in its analysis and comparison of various countries' poverty situation. The Human Development Index (HDI), Human Poverty Index (HPI), and currently the Global Multidimensional Poverty Index (MPI) created using a method developed by Alkire and Foster (2011) are such an attempt to use this poverty measure. One main challenge of the multidimensional measurement methods have been what indicators to include. However, selecting these elements for a particular index depends on what the research seeks to achieve. Also, the significance of an indicator for the measurement of poverty depends on how representative it is of the community's lifestyle. In this way, if

possessing a radio is substantially more typical than possessing a blender the former indicator (radio) should be weighted more prominently, such that if a person does not possess a radio, this uncommon incidence will be considered substantially more in determining the general degree of poverty than if someone does not possess a blender. Apart from the UNDP, many empirical works from all over the world have used multidimensional poverty measurement. During the 2008 UNU-WIDER development conference held in Helsinki, Finland on "*the frontier of poverty Analysis*", the majority of African scholars presented their papers on multidimensional poverty[3] (Ifelunini, 2013).

Demographic, economic, cultural, political, and social indicators are some of the ordering vectors of attributes considered in a multidimensional method of analyzing and measuring living standard deprivation. Dichotomous and polytomous qualitative, and continuous and discrete quantitative variables represent these indicators considered in a multivariate method (Costa and Angelis, 2008). Based on the ALEP approach[4], if two indicators are substitutes, poverty will decline less with a rise in indicator A for a person with larger amounts of indicator B. The opposite is clearly true when the two indicators are complements (Silber, 2007). The lowest required number is one dimension (union poverty - complete substitutability among dimensions) and the highest is all dimensions (intersection poverty - zero levels of substitutability among dimensions). These can be viewed as the extremes. If on the other hand, we take a weighted average of all dimensions, dimensions' degrees of substitutability will differ. There are many fuzzy aggregation functions, which reflect intermediate levels of substitutability between dimensions (Anonymous, n.d).

[3] Appiah-Kubi and Amanning-Ampomah (2008) worked on "Multidimensional Analysis of Poverty in Ghana using Fuzzy Sets Theory", Oyekale *et al*., (2008) worked on "Fuzzy Set Approach to Multidimensional Poverty Decomposition in Rural Nigeria", Njong (2008) worked on "Multidimensional Spatial Poverty Comparison in Cameroon: A Robust Analysis Using Stochastic Dominance Tests"

[4] This so-called ALEP approach was evaluated by Schultz (1935, cited by Lenfant, 2006)

Chakravarty *et al*. (1998) cited in Silber, (2007) defined the list of appropriate properties of a multidimensional poverty measure to be an index that fulfills poverty focus, symmetry, monotonicity, principle of population, continuity, non-poverty growth, non-decreasingness in subsistence levels of basic needs, scale invariance, normalization, subgroup decomposability, factor decomposability, transfer axiom, non-decreasing poverty under correlation increasing arrangement. These properties refer to "switches of some attribute(s) between individuals that increase the correlation of the attributes".

There have been several methods for measuring standards of living from the perspective of poverty deprivation. These techniques have been developed in various forms from one stage to the other. Nonetheless, scholars continue to refine these methodologies.

3.4.3 Important Considerations in Multidimensional Poverty Analysis

The Choice of the Poverty Dimension: In choosing dimensions, Alkire (2008) recorded five conceivable ways: choose in the capacity of the accessibility of data or in light of an authoritative convention; make certain assumption about what different people value; Follow "Public Consensus" (e.g. SDGs); depend on deliberative participatory procedures; acknowledge experimental evidence concerning individuals' qualities. It is of almost certainly that choosing dimensions is definitely not a basic assignment; consequently, Clark and Qizilbash (2005) have named this issue as the "horizontal vagueness" of poverty.

The "Fuzzy Aspect" of Poverty: Determining an unambiguous threshold that differentiates between the individuals who are poor and the individuals who are not poor is another colossal

assignment. For instance, it is a more complex finding threshold for dimensions such as "shelter" or income. The Fuzzy Approach to Multidimensional poverty seeks to solve such a problem.

***The "Vertical Vagueness" of Poverty*:** "Vertical vagueness" as expressed by Clark and Qizilbash (2005) highlight that choosing which individual (household) is poor is likewise not a simple assignment in a multidimensional framework. This brings in the concept of "intersection" and "union" that deals with whether individuals (households) are called "poor" only when they are poor in all dimensions or when they are poor in one dimension respectively. In-between these two concepts is the "intermediate".

***The "Temporal Vagueness" of Poverty*:** "Temporal vagueness" also by Clark and Qizilbash (2005) alludes to the unit of time one should choose while analyzing poverty. The unit of time possibly considered from two distinct edges. First is the complexity amongst Chronic and Transitory poverty. A reference from Hulme and McKay (2008) in Silber, (2007) states that "For many people, poverty is not a transitory experience or a seasonal problem: it is a situation from which escape is very difficult, most emphatically illustrated by deprivation which is transmitted from one generation to the next". In the eighteenth-century France, a similar argument was made when a distinction was made between the pauvres (experienced occasional poverty when crops fizzled or interest for casual agriculture work was low) and the indigents (for all time poor because of ill health (mental and physical), age, accident, and liquor addiction). Hulme and Shepherd made similar contributions to the distinction between structural and stochastic poverty. The second is the idea of Vulnerability. Calvo and Dercon (2008) cited in Silber, (2007) stressed the significance of the ex-ante outcome of the likelihood of future hardship. For them, vulnerability is seen as the magnitude of the threat of poverty, estimated ex-ante, before the revealing of uncertainty. These

essential issues should be tended to broadly so as to achieve a good analysis and measurement of living standard deprivation.

3.4.4 Techniques for Multidimensional Poverty measurement

A report by Afenso *et al.*, (2015) on *Multidimensional Poverty*, described some few techniques for measuring multidimensional poverty. These techniques include a dashboard, composite indices, multivariate statistical methods, and fuzzy sets. Different authors, on the other hand, discuss various techniques or approaches to the topic in the ordinal and cardinal perspective.

The Ordinal Approach to Multidimensional Poverty Measurement

The limitations of the counting approach have challenged recent scholars to suggest alternative ways of aggregating multidimensional poverty indices. Berenger, (2015) highlighted the contribution of methodological refinements to the counting approach and identified some of this weakness to include the problem of choosing dimensions, the uncertainty of the cut-off used to identify multidimensionally poor individuals across the dimensions as well as the question of sensitivity of the MPI to the inequality of deprivation across individuals. Furthermore, the approach did not account for the distribution and the correlation structure between dimensions.

Although most of the indicators for aggregating MPI or found in survey data that capture direct achievements are ordinal in nature, the counting approach on which the MPI relies cannot be used to aggregate the traditional poverty indices that are based on continuous variables. Therefore, Silber and Yalonetzky (2013) suggested a framework that integrates ordinal variables into the measurement of multidimensional poverty to address the above concerns. Others include Alkire

and Foster approach (2011) which was adopted by the UNDP to construct the MPI. Similar suggestion came from Rippin (2010) and those that rely on the extension of the Aaberge and Peluso approach, proposed by Silber and Yalonetzky (2013) as well as others implicit measures of poverty presented as a class of social exclusion measures by Bossert *et al*., (2013) or are subgroups of this family (Jayaraj and Subramanian, 2010) and Chakravarty and d'Ambrosio (2006).

These studies were intended to capture information on the incidence, intensity and to solve the issue of inequality, captured by the spread of simultaneous deprivations across the population**.** These methods can also be said to have the same properties as continuous variable type multidimensional poverty indices (Bossert *et al*., 2013). From literature, studies that consider the case of ordinal variables are less common. This informed Silber and Yalonetzky (2013) to review them.

The Cardinal Approach to Multidimensional poverty measurement

The article "*Measuring Poverty: Taking a Multidimensional Perspective*" by Silber (2007), presented at the yearly gathering of the Spanish Symposium on Public Economics in Santander and delivered on Multidimensional Poverty And Deprivation discussed the cardinal approach in details. The goal of his presentation was to reexamine the fundamental problems that must be confronted when adopting a multidimensional technique to poverty and to provide an overview of the measures that have up to this point been proposed to tackle these issues. This section will, therefore, base much on such a presentation.

In dealing with the Cardinal Approach to Multidimensional poverty measurement, one has to make two clear distinctions. First, "approaches that lead to the derivation of an aggregate indicator on the basis of which a poverty threshold (line) will be determined and traditional measures of

unidimensional poverty will be derived". Secondly, "multidimensional approaches where a poverty threshold is determined for each dimension leading to the definition of multidimensional indices of poverty". Two possibilities once more arise in the second case: i) to aggregate foremost the dimensions and then the individuals; ii) to aggregate foremost the individuals and then the dimensions. The diagram below describes the several means of developing a multidimensional poverty index.

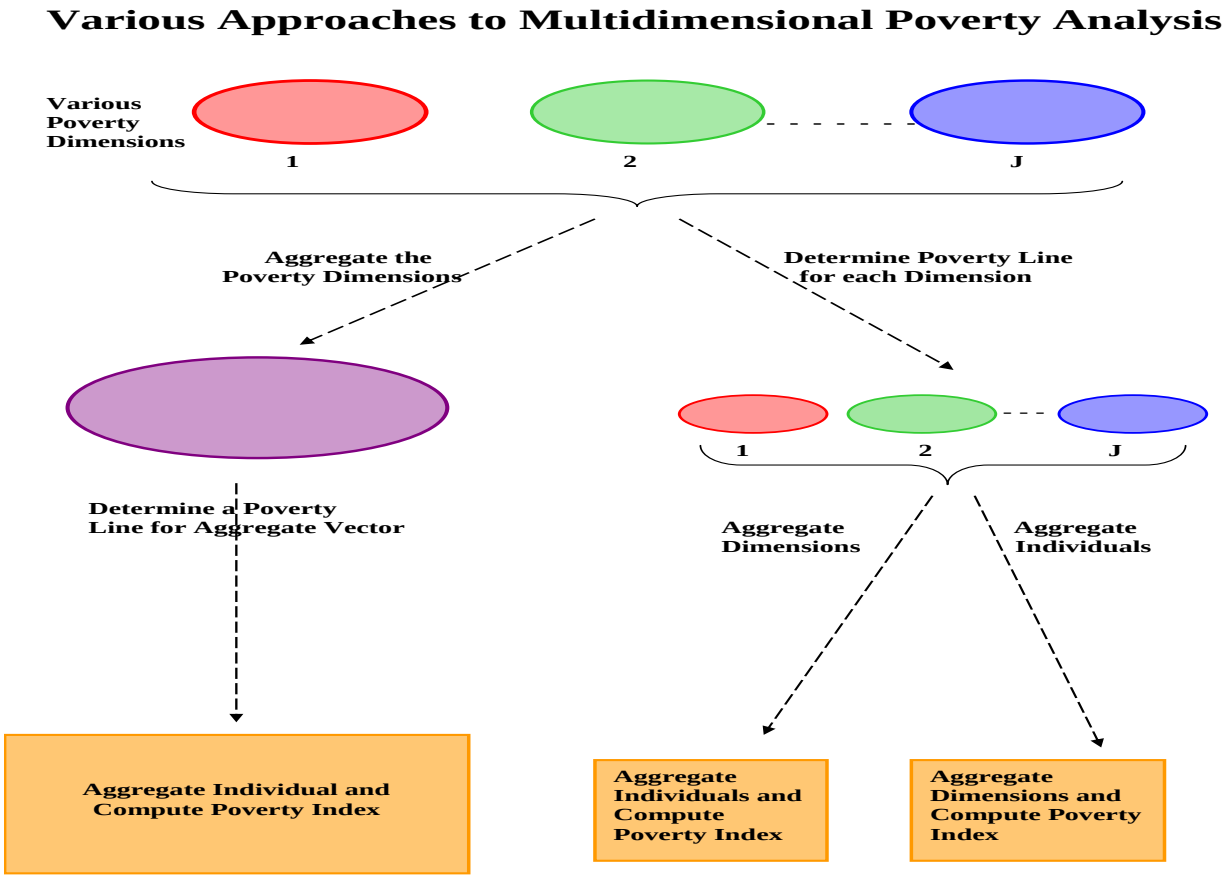


Figure 3.2: Various approaches to multidimensional poverty analysis

Source: Silber, (2007)

A. Aggregating first the dimension and then the poverty lines

Scholars have proposed many techniques in this case[5]. Some of them include:

i. Approaches that use traditional multivariate analysis

These traditional multivariate approaches rely on a latent variable. Below are examples of such techniques.

***Principal Component Analysis (PCA)*:** This approach is an "aggregating technique that seeks linear combinations of the observed indicators in such a way as to reproduce the original variance as closely as possible".

***Factor Analysis (FA)*:** The observed values in this technique are hypothesized to be linear functions of a specific number of unseen latent variables called factors, which is illustrated as $y = Mf + \varepsilon$, where y is the observed variables, f – latent variable and M - a coefficient matrix

***MIMIC Models*:** This model according to Joreskog and Goldberger, (1975) means "Multiple Indicators, Multiple Causes", embodies a step further in the clarification of the phenomenon under examination since it isn't just trusted that the observed variables are expressions of a dormant concept yet additionally that there are different exogenous factors that originate and impact the inactive factor(s). That is: $y = \alpha f + \varepsilon$; $f = \beta x + \delta$, where y alludes to indicators, while here, x refers to "causes".

[5] Read kakwani and silber, (2008) for more details

***Structural Equation Models*:** This model is summarized to include the following equations[6]: $My^*+Nx^*+u=0;\ \ y=My^*+\varepsilon;\ \ x=\phi x^*+\delta$ **,** where y^* is the latent endogenous variables**;** x^* is the latent exogenous variables, and both y and x are the observed indicators consistent with y^* and x^*.

***Multiple Correspondence Analysis (MCA)*:** This approach easily combines quantitative variables and categorical variables, albeit obviously the later ought to be ordinal in poverty analysis.

Cluster Analysis: The cluster Analysis is an approach that allows the categorisation of comparable objects (original population) into various groups (subsets or cluster) with the goal that the data in every subset share the same basic characteristics

ii. The Rasch Model

The Rasch Model also based on the idea of a latent variable. It has its place initially with the field of psychometrics – a discipline that endeavors to measure inert characteristics, for example, sociability or intelligence which can't be seen openly and must be deduced from their outer sign expression (Rasch, 1960). Dickes (1989) applied it to poverty and assumed that "poverty (a latent variable) is a continuum, hence, on the basis of a set of heterogeneous information (eg. Health and housing), it is possible to rank individuals according to a criterion that would be homogeneous".

[6] An empirical illustration is found in Ballon and Krishnakumar, 2008, and Krishnakumar, 2008

iii. Efficiency Analysis

The Efficiency Analysis is widely applied using the concept of distance functions but rarely applied to the analysis of household behaviour (Deutsch and Silber, 2005). This idea of distance function may clearly be applied when connecting an output to inputs x. It is in the form of output and input distance functions, where the concept of output distance function is applied when utilising the idea of production possibility frontier (PPF) and the idea of input distance function is applied when the transformation function is fitted for input such that two inputs, q_1 and q_2 are utilized in generating output vector, u. To illustrate this, let q represent a subjective quantity vector, and u a subjective utility indifference curve (isoquant).

iv. Information Theory:

As indicated by Deutsch and Silber (2005), despite the fact that information theory was initially created by engineers in the field of communications and was presumably applied first to economics by Theil (1967), the first scholar that borrowed the concepts of information theory to determine measures of multidimensional prosperity and multidimensional inequality in well-being was Maasoumi (1986). Just as Maasoumi (1986) used evidently entropy related inequality indices to compute an index measuring the degree of inequality of distribution of this amalgamated indicator x_c, Miceli (1997), also used a relative technique to poverty to estimate the proportion of poor in the populace, based on the distribution of this amalgamated index x_c.

v. **The concept of order of acquisition of durable goods**

Paroush (1963, 1965, and 1973) proposed utilizing data accessible on the acquisition of durable goods to appraise the living standards of households. A number one (1) means the household owns a certain good whilst zero (0) indicate otherwise. At this point, there is an assumption that those who possess any of the goods have the highest level of deprivation whilst the converse holds. Information gathered on the ownership of five good indicates $2^5 = 32$ possible profile of the ownership. An ordered logit regression can be estimated with the level of deprivation as a function of variables like health, education, and age.

B. Determining first poverty lines for each dimension

There are two possibilities in this case:

a. Aggregating the dimensions and finally aggregating the individual observations

***The Axiomatic Approach*:** The basic idea behind the studies on this approach viewed a multidimensional index of poverty as a collection of shortages of all the considerable number of people in the sense that the individual does not have even the base level of the basic need (Deutsch and Silber, 2005).

Information Theory: The multidimensional poverty indices that are derived from this theory were defined by Maasoumi and Lugo (2008). The difference between this and what was said before is that poverty thresholds are drawn distinctly on every dimension.

The Subjective Approach: This approach is also referred to as Cardinal Probit (CP) (Van Praag and Ferrer-i-Carbonell (2004). It begins with the question of how households assess their own circumstance of health, job, etc, in terms of verbal labels, for example, 'adequate', 'great', 'terrible' among other. "It is obvious that such domain satisfactions might be correlated so that the likelihood would involve a bi-variate normal integral. Van Praag and Ferrer-i-Carbonell (2008) conclude that it is possible to interpret overall poverty as a weighted sum of domain poverties and that there is a trade-off between the domains. For instance, less job satisfaction may be compensated for by higher financial satisfaction" (Silber, 2007)

The MPI methodology/Alkire Foster method:

This method is also called Adjusted Headcount (M_0) as it is headcount index (percentage of poor in the society) multiplied by the average number of deprivations. The MPI straightforwardly measures the nature and magnitude of interrelating deprivations in health, education and living standard for each household. This was made possible because the Alkire Foster method and many other approaches of multidimensional poverty measures are flexible and can be utilized with different dimensions, indicators, weights, and cut-offs to produce measures particular to different societies and circumstances[7] (Alkire and Roble, 2017). Apart from dimensions with equal weights considered earlier by Alkire and Foster (2011), Alkire Foster methodology also considers dimensions that potentially are weighted differently. The Global MPI was propounded by the Oxford Poverty and Human Development Initiative (OPHI) in partnership with UNDP is derived from this approach; the class of poverty measures proposed by Alkire and Foster (2011). The approach is updated for countries with new data.

[7] Some authors use dimension, indicator and attribute simultaneously

b. Aggregating the individual observations and finally aggregating the dimensions

Fuzzy Set Approach

Zadeh (1965) developed the mathematical theory of "Fuzzy Sets" based on the concept that some category of objects may not be well-defined by extremely exact criteria of membership. In some cases, one can't Figure out which elements have a place in a given set and which ones do not. Fuzzy sets can be viewed as generalizations of classical sets, in that they are classes inside which the conversion from membership to non-membership happens steadily. Simply put, a class with a continuum of ranks of membership (Naidoo, 2007). Mathematically the fuzzy set can be demonstrated as:

Let there be a set X , and x be an element of X . A fuzzy subset A of X is defined as the set of the pairs $A = \{x, \mu A(x)\}$ for all $x \in X$ where μA is an application of set X to the closed interval [0, 1], which is called the membership function of the fuzzy subset A . The closer the value of the membership function is to 1, the more prominent the degree of membership of x is to A . (Naidoo, 2007; Deutsch and Silber, 2005)

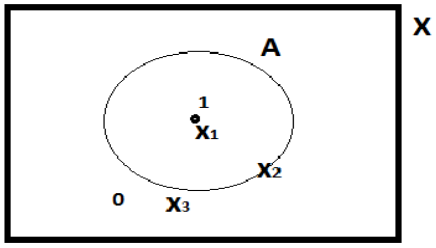


Figure 3.3 Fuzzy membership;

Source: Author's illustration

In ordinary set theory, the membership function can be written as:

$\mu A(x) = 1$, if x belongs to subset $A(x_1)$ and $\mu A(x) = 0$, if x does not belong to the subset $A(x_3)$

However, if A is a fuzzy subset, then the membership function can be written as:

$\mu A(x) = 0$, if x does not belong to the subset $A(x_3)$

$\mu A(x) = 1$, if x completely belongs to the subset $A(x_1)$

$0 < \mu A(x) < 1$, if x belongs partially to the subset $A(x_2)$

The idea of the fuzzy set has been used successfully in the study of poverty and living conditions by a number of authors both for quantitative and qualitative variables. Among them are Vero and Werquin (1997), Qizilbash (2006), and Deutsch and Silber (2005). The effort of Cerioli and Zani (1990), Cheli and Lemmi (1995), and Betti and Verma (1999) has given rise to the contemporary input representing a continuance and additional development of the approach (Betti and Verma, 2007). Cerioli and Zani (1990) created a fuzzy theoretical model for multidimensional analysis to empirically apply this method to poverty. They called their approach the Totally Fuzzy Approach. This approach takes a whole series of variables.

In the literature, three different types of variables capture deprivation in the dimensional attributes: ***Binary or Dichotomous variables*:** These are variables, whose indicators are defined from the issue of owning or not owning durable goods, for example, land, radio, poultry, among others. The treatment of the binary variables in a fuzzy approach is redundant as the resulting fuzzy membership functions also yield binary outcomes. This is demonstrated by assuming binary variables have a decreasing risk of deprivation, where 0 represents (does not possess) deprivation

and 1 represents (does possess) non-deprivation. The 'have' attribute is associated with a low risk of deprivation, whilst the 'have not' has a high risk of deprivation. The two attributes have the values of 0 and 1 in the closed set: [0, 1], whereby 0 takes the low risk of deprivation (absence of deprivation or minimum risk) and 1 takes the high risk of deprivation (absolute deprivation or maximum risk) (Appiah-Kubi *et al*., 2008). The membership function is therefore defined here as per the case of traditional sets (Deutsch J. and J. Silber, 2005).

***Ordinal, Discrete Categorical or Polytomous variables*:** Ordinal variables, used in deprivation measurement are generally qualitative in nature and depict different levels of well-being through multiple modal values. They may take more than two values. Discrete categorical variables with specific and discrete static points of values at any specified time such as education level are treated in a similar manner. These variables imply decreasing the risk of deprivation. Three properties need to be ensured before the polytomous variables are incorporated into the formulation. First, modal values that imply an increasing risk of deprivation have to be recorded/rearranged in decreasing risk of deprivation. An example would be asking individuals to evaluate the health condition as very bad, bad, medium, good, very good. Secondly, consecutive integers between 0 and $m-1$ have to be assigned to denote m number of modal values. Third, the highest modal value (or lowest risk after ordering) should always denote the threshold level of well-being. An implicit assumption used here is that modal values are evenly spaced. The membership function $\mu_{\beta_j}(i)$ for the household i can be defined as follows:

$$\mu_{\beta_j}(i) = \begin{cases} 0 & \text{if } \alpha_{1j} < \alpha_{1\min} \\ \dfrac{\alpha_{1j} - \alpha_{1\min}}{\alpha_{1j\max} - \alpha_{1j\min}} & \text{if } \alpha_{1\min} < \alpha_{1j} < \alpha_{1\max}] \\ 1 & \text{if } x_{1j} > x_{1\max} \end{cases} \qquad (3.1)$$

Where $\alpha_{1\min}$ and $\alpha_{1\max}$ represent the lowest and highest values assumed by the scores α_{1j}.

Continuous or ratio scale variables: These are variables such as "income or expenditure that it's mass function has no definite or discrete fixed points of values. However, such an indicator can be categorised in stages or in groups such that their relative membership functions can be assigned to each category to allow a general membership function to such indicator to be defined" (Appiah-Kubi *et al*., 2008). Generally, two distinct types of continuous variables are found in survey data. The first type of variables implies decreasing risk of deprivation (e.g. income and wealth), while the second type implies an increasing risk of deprivation (e.g. debt and housing cost burden). In the case of continuous variables, Cerioli and Zani (1990) defined two threshold values $x_{\min}$ and $x_{\max}$ such that if the value x assumed by the continuous indicator for a particular person is smaller than $x_{\min}$, this individual would definitely be defined as poor. On the other hand, if it is higher than $x_{\max}$ he is definitely not poor. Assume x_j be the subset of households that are in an unfavourable condition with respect to attribute j, ($j = 1, 2, ..., k$). The membership function can be defined as:

$$\mu_{x_j}(i) = \begin{cases} 1 & \text{if } 0 < x_{ij} < x_{j\min} \\ \dfrac{x_{j\max} - x_{ij}}{x_{j\max} - x_{j\mathrm{mn}}} & \text{if } x_{ij} \in [x_{j\min}, x_{j\max}] \\ 0 & \text{if } x_{ij} > x_{j\max} \end{cases} \qquad (3.2)$$

Where $x_{\min}$ and $x_{\max}$ stand for the minimum and maximum thresholds that were considered.

Cheli *et al*. (1994) and Cheli and Lemmi (1995) proposed a modification of the Totally Fuzzy Approach (TFA) by developing the deprivation indices straight from the distribution function of the attributes measured and introduced the Totally Fuzzy and Relative Approach (TFR) (Deutsch and Silber, 2005). These modifications resulted from the fact that the fuzzy set approach has two

dire levels instead of arbitrary one minimum level, below which a household categorically fits into the set of poor and a maximum level, above which a person categorically does not fit into the set of poor persons as proposed by Cerioli and Zani (1990). If a household falls between these two levels then that household partially belongs to the set of poor households instead of the membership function being a linear function (Naidoo, 2007). In addition, the TFR approach has the benefit of adopting a relative approach to poverty (the one which is taken in most developed nations), according to which one is typically poor in relation to some other individuals. Therefore, Cheli and Lemmi (1995), $\mu(x_{ij})$ proposed the following solution defined with respect to the distribution function $\mathrm{F}(.)$ of x_j for TFR method:

$$\mu(x_{ij}) = \begin{Bmatrix} F(x_{ij}) & \text{if } j \text{ increase as } x_j \text{ increase} \\ 1-F(x_{ij}) & \text{if } j \text{ increase as } x_j \text{ decrease} \end{Bmatrix} \tag{3.3}$$

The normalized form is given by:

$$\mu(x_{ij}) = \begin{Bmatrix} 0 & \text{if } x_{ij} = x_j^{(1)} \\ \mu(x_j^{(\mathrm{k}-1)}) + \dfrac{\mathrm{F}(x_j^{(\mathrm{k})}) - \mathrm{F}(x_j^{(\mathrm{k}-1)})}{1-\mathrm{F}(x_j^{(1)})} & \text{if } x_{ij} = x_j^{(\mathrm{k})}, (\mathrm{k}>1) \end{Bmatrix} \tag{3.4}$$

where $x_j^{(1)}, x_j^{(2)}, ..., x_j^{(\mathrm{m})}$ are the categories of the variable x_j, arranged in increasing order in respect of risk of poverty ($x_j^{(1)}$ denotes minimum risk; $x_j^{(\mathrm{m})}$ denotes maximum risk), and $\mathrm{F(x)}$ is the distribution function of x_j.

The second phase of the investigation is to estimate the general level of deprivation $\mu_j(i)$ of individual i (overall dimensions). A weight that fulfills the above property is suggested by Cerioli

and Zani (1990) and can be represented with the following expression: $w_j = \log\left[\frac{n}{\sum_{i=1}^{n} x_{ij} n_i}\right] \geq 0$

with $\sum_{i=1}^{n} X_{ij} n_i > 0$, where n_i is the weight attached to the i^{th} sample observation when the data are extracted from a random sample or census of households.

In the final stage of the analysis, Cerioli and Zani (1990) suggested that the average level of deprivation in the populace (overall index of poverty), P, should be computed The overall index of poverty, P, for the whole populace would then be able to be Figured by taking the arithmetic mean of the individual poverty indices[8] as $P = \frac{1}{n}\sum_{i=1}^{k} f(x_i)$ where P can be understood as the proportion of individuals that belong to the fuzzy subset of the poor (a fuzzy generality of the headcount ratio of the poor). In the exceptional situation when $f(x_i.)$ only takes values 0 and 1, (i.e. when x isn't a fuzzy subset), P matches the headcount ratio of the poor. Any individual whose deprivation level $\mu(i)$ will be greater than μ_{mean} will be considered to be poor and this enables us to calculate the proportion of poor in the population. Costa (2002) in a further modification outlines an alternative method for estimating the membership degrees into a multidimensional composite deprivation or poverty index, which enables the fuzzy set framework to attain a unidimensional poverty ratio for each of the j attributes considered. Appiah-Kubi *et al*., (2008) states based on this that the variance between the multi-dimensional and unidimensional poverty ratios lies in the weight. The TFR approach can be concluded with a quote from Naidoo A. G. V.,

[8] The derivation of the overall index, P, as well as a unidimensional poverty index of the fuzzy approach has been explained thoroughly in Appiah-Kubi *et al.,* (2008)

(2007) that "the overall membership function acts as a deprivation indicator showing each household's overall deprivation relative to its surroundings".

Vero and Werquin (1997) recently proposed an additional "fuzzy approach" to multidimensional poverty measurement to deal with indicators that are highly correlated.

The fuzzy index is aimed at removing dual arbitrary cut-off present in some other approaches. The idea behind the fuzzy set approach can be summarised in a quote from Chiappero-Marinetti (2006), which states that, "*in fuzzy environment, the conventional hard threshold, which determines an unambiguous distinction between poor and not-poor, is substituted by a soft threshold that depicts an intermediate, gradual representation between acceptable and unacceptable living conditions, or adequate and inadequate levels of well-being, without establishing a single abrupt cutoff line".*

Additional approaches to poverty include the Qualitative approach to poverty analysis and learning from other social science that encapsulates i) the contribution of anthropology to poverty analysis ii) Participatory Approaches and iii) taking Psychology into account. It must be noted that qualitative studies often complement quantitative surveys.

Based on the same database (1995 Israeli Census), Deutsch and Silber, (2005) attempted to compare four approaches: the fuzzy approaches, information theory, the efficiency approach and axiomatic approach and established that in most instances there were no much variances in the numerous multidimensional poverty indices that have been applied, at least as far as the impact of poverty on several explanatory variables were concerned. This reveals that multidimensional approaches to poverty are a useful complement to the traditional approaches.

2.4.5 The conceptual framework

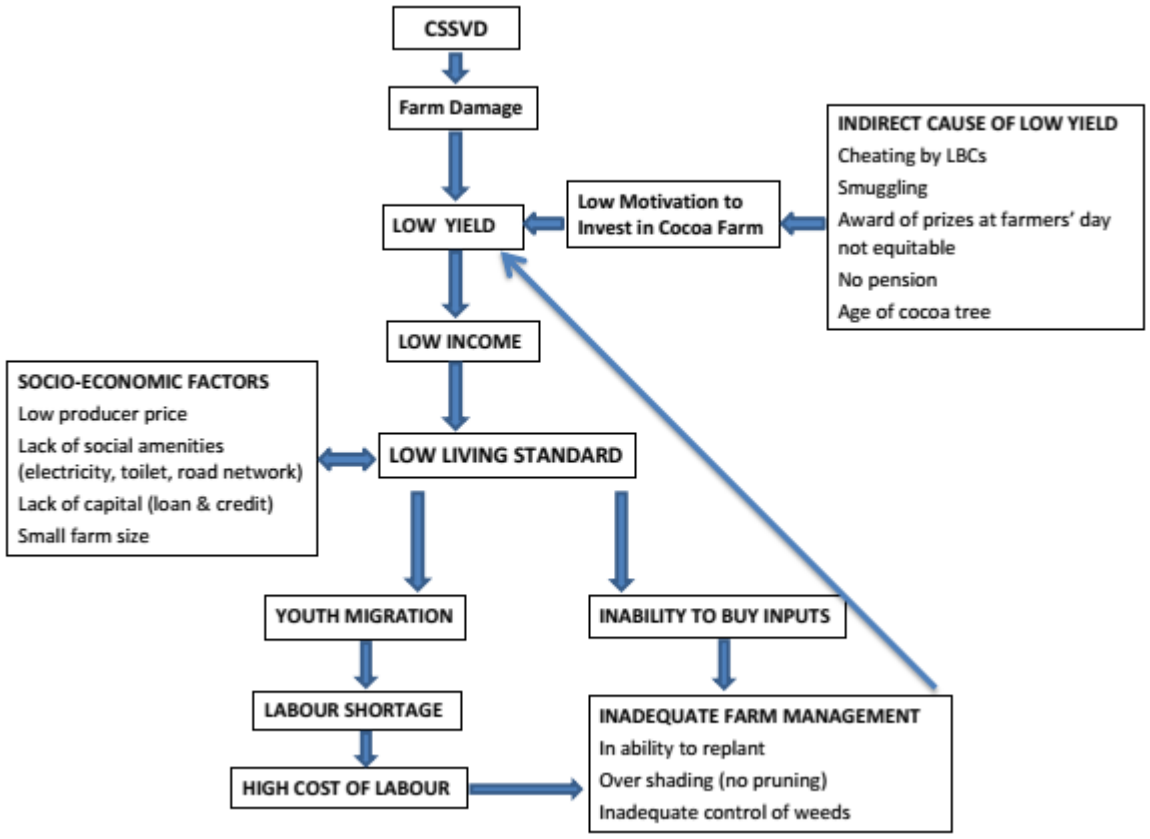


Figure 3.4: Conceptual Framework of CSSVD

Source: Author's illustration in line with Dormon, (2004)

The CSSVD like any other disease causes farm damage, which leads to low cocoa yield. The low yield will result in low income and hence the low living standards of cocoa farmers. The low living standards will intern result in their inability to negotiate for socio-economic benefits such as high producer price, social amenities, and credit. Their low living standards do not also allow them to farm on a larger scale. These challenges continue to deepen their low standard of living. A low standard of living surely leads to youth migration. The migration of the able-bodied youth to find greener pastures in the cities results in a labour shortage, hence the high cost of labour.

With a high cost of labour and the inability to buy inputs as a result of low living standard, it becomes very difficult for a cocoa farmer to effectively manage their farms. Farmers' inability to manage their farms will eventually reduce the cocoa yield. Other factors that indirectly cause low cocoa yield include cheating by cocoa buying companies (LBCs), smuggling, no cocoa farmers' pension scheme, old age of cocoa trees and inequitable award of prizes at farmers' day. These demotivate farmers and new entrants from investing in the industry.

3.5 Empirical Literature Review

This subsection reviews the related empirical studies of the subject under consideration: CSSVD and living standards of cocoa farmers.

3.5.1 The Spread of CSSVD and Its Management

Through field inspection, Domfeh *et al*., (2011) in their paper, cocoa swollen shoot virus disease in Ghana; a review of current trends, studied about the swollen shoot control efforts in Ghana from 2006 to 2010 and discussed the way forward. The study found out that a ton of endeavors is being made to curtail the swollen shoot virus disease in Ghana, be that as it may, the disease keeps on spreading, even to zones with no history of swollen shoot infection. Aside from the conscious effort made to curtail the disease, a huge backlog of diseased trees needs to be treated. Besides, the Western North has turned out to be the new epicenter of the CSSVD in Ghana. Domfeh *et al*. (2011) also pointed out that there have been many recommendations to tackle CSSVD from a few fronts since the 'cutting-out' alone has not possessed the capacity to deal with the persistent spread

of the disease. Farmers are therefore encouraged to rigidly implement suggestions such as barrier cropping, application of recommended planting materials, removal of all CSSV alternative host plants, demonstration farms incorporating the new innovations to be established in farmers' farm and strengthen farmer education on the menaces of useless treatment or complete abandonment of treatment of the disease.

This assertion is not different from Dzahini-Obiatey *et al*., (2010) review of different studies in over seven decades of a viral disease of cocoa in Ghana; from researchers' standpoint that attempted to address all the disciplines of CSSVD together, in addition, to suggest the way forward in managing the disease. The paper concluded that an integrated approach of the planting of hybrids resistant to CSSV, together with the planting of the chosen materials in blocks and separating the blocks with non-host crops barriers would be a more effective solution. The breeding of new and resistant varieties to CSSVD in conjunction with the isolation methods mentioned above were suggested specifically for disease-epidemic areas.

For Padi *et al*. (2013), since the cutting-out is the single existing technique of controlling the disease in less affected areas, managing the disease with full-sib families with a high fraction of symptomless individuals will be of little value in these areas hence a recommendation of selecting a resistant to infection by CSSV and the breeding for varieties less preferred by the mealybug vector may be of value.

Ameyaw *et al*., (2014) puts into perspective a portion of the difficulties connected to the management of CSSVD and discussed the purposes behind the expanded spread of the disease. The study found out that the advice to farmers to leave a 10m cordon around new cocoa plantings isolating them from old plantations and forest trees amid restoration has not been completely clung to. The paper shares a similar stand with Dzahini-Obiatey *et al*., (2010) and Domfeh *et al.*, (2011)

by proposing the use of holistic approach by joining the different proposals on the virus into a suitable bundle for simple acceptance by farmers. Effective farmer re-education on the disease, a continuous research effort to develop tolerant cocoa varieties, designing early detection techniques for the virus and effective control methods for the vectors are some of the approaches to be considered. The use systematic insecticides on pod-bearing cocoa trees to curtail mealybug vectors according to Ameyaw *et al*. (2014) keep on being unreasonable because of the poisonous quality bringing about the danger of corrupting the cocoa beans delivered by the showered tree.

Meanwhile, Kouadio *et al*., (2017) investigating the potential of baron application to improve yield and tolerance of cocoa trees naturally infected by the virus in addition to the effective dose and time of application found that baron application improves foliar density as well as induce production of normal pods shape. It, however, reduces the appearance of the warp from CSSV with the ideal dose of baron to reduce the adverse effects of most virulent form CSSVD being 41.67 g/ha.

Finally, an extensive literature review conducted by Andres *et al*., (2017) followed by a meta-analysis to expound on the relative adequacy of different preventive control measures for CSSVD. A hypothesis that the preventive control measures identified with diversification (barrier (strip) cropping, shading/agroforestry) lessen CSSVD infection meaningfully more than those measures that identify with breading and mild strain cross-protection. The outcome of the research showed that resistance breeding and mild strain cross-protection reduces CSSVD infection by about 30 percent. The potentials of diversification measures seem to be considerably higher at about 40 to 85 percent respectively. It is, however, much focus has been laid on resistance breading and mild strain cross protection than diversification measures. A further study into diversification measures was therefore recommended. Other recommendations were that the barrier (strip) cropping and

shading/agroforestry systems should also be adopted to complement breeding and mild strain cross-protection, as these shows most prominent potential to decrease CSSVD in their investigation and could be actualized specifically by farmers themselves.

3.5.2 Resistance to 'Cutting Out' Method

Many challenges have been faced by the authorities of the cocoa industry in their quest to manage the disease especially with the most practical and effective method "Cutting Out" since 1946 when this eradication method was launched. Different authors have discussed this in different ways.

Dzahini-Obiatey *et al.,* 2010 commented that "Lands have become more fragmented due mainly to inheritance and land leasing arrangements where the already small cocoa farms are further divided among the family members upon the death of the owner or between the caretaker and the landlord (Thresh et al., 1988). This has made the management of the swollen shoot disease by treatment and the isolation of replanted farms more difficult. Treatment of infected trees is done with the consent of all the farmers". Land tenure security and the seeming loss of livelihood via the cutting out of cocoa infected trees are some of the factors that make it difficult for farmers to completely adopt the programme as a paramount disease control measure (Ameyaw *et al.,* 2014**).**

Padi *et al.,* (2013) added that discontinuities in the eradication program, the dormant and missed infections mainly on farms planted with tolerant varieties and farmers resistance to the elimination of infected trees are said to have been responsible for the inefficiencies in the cutting-out program. The disease is more prevalent now than ever before, even though it is generally agreed that

eliminating noticeably infected trees and their contacts is the most practical means of controlling the disease since 1944.

3.5.3 Resistant Varieties of Cocoa to CSSVD

Determining the benefits in resistance to CSSVD received from different breeding efforts at developing resistant varieties as well as examining the relative resistance to CSSVD infection of recommended varieties that dominated planting in Ghana and much of West Africa across various timelines, Padi *et al*., (2013) based on Adu-Ampomah *et al.,* (1996) study that developed varieties in 1996 with higher levels of resistance to CSSVD by using gamma rays to induce mutants in the Upper Amazon clone T85/799(mvT85). After generating full-sib progenies through manual pollination, the results showed in the first flush of leaves after inoculation that, the backcross population [mvT85 x (mvT85 x A1/154)] had the least disease occurrence with nearly 70% of the plants without symptoms whereas the mvP30 x A1/154 and the cross PA7 x Mocorongo were the least resistant. Meanwhile, Adu-Ampomah *et al.,* (1996) had proposed that absence of CSSVD symptoms in mvT85 may be as a result of either, the plant resistant mutants or the virus is existing in the plant but its multiplication is suppressed. Results from Padi *et al*., (2013) supported the latter deduction, despite the suppression mechanism of symptom appearance in the earlier studies and its successive loss of resistance in the current study remains blurred. The paper concluded that "mvT85 does not carry novel genes to contribute to developing cocoa varieties with enhanced resistance to CSSV disease".

In comparing varietal groups, Padi *et al*., (2013) found that the "old varieties have much higher disease severity ratings compared with the current and new set of varieties". The higher weakness

of the West African Amelonado and Trinitarios to CSSV infection clearly is revealed by the substantial advantages of the new and current varieties over the old varieties (Legg and Kenten, 1968; Posnette, 1981). For the areas of mass infection where cutting-out is not permitted, varieties with a long latent period, higher canopy deterioration, and high vigour may be required whereas less affected areas require varieties that show visible symptoms to make cutting-out effective. Irrespective of these significant gains, the study claims that "little genetic gains for resistance have been achieved from breeding for resistance to CSSV over the past seven decades".

Ameyaw *et al*. (2014) also restated this by saying that "these Inter-Upper Amazon hybrids were generally more resistant to CSSV infection than the equivalent series II hybrids (Upper Amazon x Amelonado and Upper Amazon x Trinitario) and were therefore recommended for farmers to be used in new cocoa plantings. Over the years, it has become apparent that the level of resistance of these varieties to CSSV is not adequate for long-term protection from infection. The search for cocoa varieties with improved resistance through screening of new cocoa germplasm, mutation breeding, and tissue techniques has been on-going".

3.5.4 Standard of Living of Cocoa Farmers

Schulte-Herbrüggen (2011) researched the perspective of depleted wildlife populations to contribute to poverty alleviation through the sales of bushmeat. The research was carried out on a rehashed socio-economic questionnaire with N=804, conducted over twelve months among 63 households in Wansampo: an agricultural community situated in a forest reserve in Sefwi Wiawso District (currently in Akontombra District) of Ghana and next to Chorichori, the case study community. Gross monetary and non-monetary incomes were obtained from the repeated socio-

economic survey using a combination of 24 hours and 2 week-recall periods. The result of the study showed that over half of households were poor or extremely poor. Generally, a fourth of the households were poor and another quarter was extremely poor. The level of extremely poor households increases excessively when cocoa production is out of season. This comprises half of the poor households during the cocoa season but 78% and 84% after and before the crop season. Poverty is, therefore, highest for the duration of the lean season (greater than 60% of households) and lowest during the peak season (35%).

Similar results came out from a survey that Asamoah *et al*. (2013) steered to find insight into the living standards of cocoa farmers in Ghana with a total of 637 households (3392 individuals) randomly sampled utilizing a multi-staged sampling approach from eleven cocoa districts. The study intended to seek for the yearly household expenditure as a proxy indicator and liken it with the national living standards so as to stratify the farmers by poverty status. The results showed that "7.4 percent of the sampled population was extremely poor with the total annual expenditure of less than GH¢443.61 while 11.4 percent were poor with less than GH¢570.31. An analysis of the poverty gap revealed that a person needed an average of GH¢135.45 (about $68) or up to GH¢397.00 per annum to be lifted up from extremely poor to the upper poverty line". They realized that poorer cocoa farmers required the money equal to two bags (125kg) of dry cocoa to in order to fulfill their basic consumption requirements and hence proposed that small-scale cocoa farmers should be assisted to adopt yield-improving technology that will increase their present low production below 400kg.

Kumi and Daymond, (2015) also used farmers' household expenditure in 2012 as a proxy indicator in and compared with the national poverty lines set by the Ghana statistical service to analyse the poverty levels and standard of living of cocoa farmer in the Bibiani-Anhwiaso-Bekwai District of

the Western region of Ghana. The paper had worse result compared to Asamoah *et al.,* (2013) as a "4.7% of cocoa farmers were extremely poor having a total annual household consumption expenditure of less than GH¢ 623.10 ($310.00) while 8.0% were poor with less than GH¢ 801.62 ($398.81). An amount of money ranging from GH¢ 20.00 ($9.95) to GH¢ 89.04 ($44.29) per annum was needed to lift the 4.7% of cocoa farmers out of extreme poverty, which could be achieved through modest increases in productivity".

Addressing the numerous problems of cocoa farmers in Ghana, Hainmueller, (2011) through the Cadbury Cocoa Partnership (CCP) initiated a programme preceded by a survey to measure economic and social indicators before implementing the key components of the programme to enable comparisons after implementation with data gathered. In all, 335 farming households and community leaders in villages in Eastern, Central, Ashanti, Brong Ahafo and Western regions were surveyed. Approximately 3,000 cocoa farmers were interviewed and 13,400 household members provided information. Key results that stood out were that productivity, in general, is low. This is as a result of simple farm practice and the insignificant use of fertilizer. Moreover, "the low productivity results in extremely low incomes for cocoa farming households. This situation describes a kind of poverty trap in which extremely low income prevents the adoption of more advanced farming practices, including the use of fertilizers and pesticides". In addition, "these conditions coincide with cocoa farmers' own assessments of their situation that suggest that the general trend is worse rather than better, hence, less than half of cocoa farmers would recommend to their children to follow in their footsteps". They, however, believe that opportunities are better in others sectors. There were less than 10% of farmers who reported to be members of a farmers' association. This shows that farmers are not recognized in ways that allow them to confront their challenges. Roads, education, and health were the type of infrastructure that

was ranked to be the top priorities according to separate responses from farmers and village leaders.

Investigating the sustainability of cocoa farmer livelihood Peprah, (2015) in addition to the above-laid emphasis on factors that intensify or disrupt the viability of cocoa farmer standard of living. A total of 264 farmers were drawn from 774 and quantitative and qualitative data obtained from appropriate state institutions. The results indicated that cocoa farmer livelihood offers larger secondary livelihoods for labour-sellers, petty traders and workers of cocoa marketing firms. The cocoa farmer livelihood also faces dangers from the new oil found, service and industry. Preliminary capital assets, land degradation, corruption in the internal cocoa marketing and inflation are major challenges that the cocoa farmers face.

3.5.5 Occupation Diversification of Cocoa Farming Households

Knudsen (2007) challenged the view that "the increasing importance of income earned on non-farm activities is a direct expression of processes of 'deagrarianisation'". The paper empirically drew prove from late research in the Ghanaian cocoa frontline. The result of the study showed that a developing significance of income from non-farm activities is self-evident; nonetheless, that income from cocoa is as yet the deciding variable for most households' income. Knudsen (2007) distinguished and addressed two general factors explaining the level of income diversification and 'deagrarianisation' in the Ghanaian Case. First, the actual crop cultivated and its price and marketing possibilities are of pronounced significance for a farmer's choice to participate and remain in the agricultural sector or to diversify into non-farm activities. Secondly, diverse dynamics are obvious between settlements dominated by either migrant or indigenous households,

primarily due to unequal access to land. The author, therefore, established that "what on a general scale may look like processes of 'deagrarianisation' during the last decade to a large extent can be explained by migrants without access to land who engage foil time in the non-farm sector and by cocoa farmers diversifying their incomes, but not leaving a deteriorated agriculture".

According to Schulte-Herbrüggen (2011), "lack of income from cocoa sales was the main determinant of poverty, yet poor households depend on farm income than non-poor households. Non-cocoa incomes that could have served as an alternative were generally lower than cocoa income. Cocoa sales were still a major source of income even for poor households. Only the chronically poor earned higher incomes from the sale of food crops than cocoa beans. The 'never poor' households earned high incomes from the sales of cocoa beans throughout the year". This category of households had a highly diversified income source throughout the year for a range of source and sectors. As income from cocoa sales decrease outside the cocoa season these households first invest and trade in provisions, thereby gaining the advantage of extra income and the purchase of their own consumable at wholesale price. Bushmeat was an important source of income in the lean season but was a minor source overall.

Asmah (2011) in the quest to examine how some chosen proxies of agricultural sector reforms have transformed over time and at the same time evaluate their relative prominence in influencing rural livelihood diversification and household welfare, used the endogenous switching regression technique and found out that both household welfare and rural non-farm diversification decisions are typically determined by households assets that include good health, education, and household age composition. Households in a community with access to fertilizers, public transport, and locally produced market are more likely to participate in non-farm diversification and enjoy enhanced welfare. Access to TV and radio as effective mass media tools in inducing household

behavior is highlighted in the analysis. The need to target interventions that enhance livelihood diversification was recommended.

Finally, Ampaw *et al.,* (2017) also investigated the impact of farm and non-farm diversification (FND) on household income and food expenditure in urban Ghana using propensity score matching (PSM) technique to account for potential selection bias. The authors found diversified households to be statistically different from undiversified households in terms of household characteristics. Age, gender, educational attainment of the household head, household size, ownership of livestock and agricultural land, and receipt of miscellaneous and rent incomes are positive and significant determinants of FND in urban Ghana. In addition, they found that participation in both farm and nonfarm activities positively and significantly impacts household income and food expenditure. In the light of growing urbanization, with its implications for unemployment, poverty and food insecurity a recommendation to diversify among urban households as a means of smoothing income and consumption is necessary.

3.6 Synthesis of Literature Gaps

It is obvious from above that poverty in Ghana is a rural phenomenon. Smallholder farmers who are the majority of people who dwell in rural areas suffer the most poverty compared to others who engage in another form of occupation. As if this is not enough, a smallholder farmer who engages in the production of cocoa is caught up in the worse situation in Ghana and West African cocoa-growing countries as the swollen shoot disease have not gotten any substantial solution.

Out of the numerous studies reviewed, it is hard to find a study which directly examines the impact of CSSVD on the living standards of Cocoa farmers. However, few that have closely researched

into the socio-economic situation of cocoa farmers focus mainly on the living standards of cocoa farmers without reference to CSSVD. In addition, these papers adopted a money-metric measurement of living standard to the neglect of a comprehensive (Multidimensional) measurement of living standards. Again, none of these studies dwelt on the impact of cocoa swollen shoot virus disease on the livelihood of cocoa farmers. In this case, the contribution of this study to the existing literature is situated in the multidimensional poverty index perspective of examining the effects of the cocoa swollen shoot virus disease on the livelihood of cocoa farmers in Ghana, the case of Chorichori in the Sefwi Akontombra District of Ghana.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Theoretical Model

4.1.1 The Multidimensional Poverty Index (MPI)

To estimate the living standards of the households of cocoa farmers in the study area, the Multidimensional Poverty Index (MPI) is adopted since the money-metric approach is considered unsuitable as it focuses only on monetary indicators. As a result, the Global Multidimensional Poverty index, in particular, is used for this study. This approach is based on Alkire and Foster (2011).

The Alkire and Foster (2011) model also called Adjusted Headcount ratio (M_0) is derived as headcount (percentage of poor in the society) multiplied by the average number of deprivations among the poor. The global MPI which follows from the Alkire and Foster methodology is described below:

Let X_{ij} represents the achievement of household $i = 1, 2, \ldots, n$ with respect to dimension $j = 1, 2, \ldots, d$. First cut-off Zj of indicator j (within dimension) below which an individual is considered deprived with regards to dimension j is defined. Again, let g0 be a 0-1 matrix of deprivation whose elements is equal to 1 if $X_{ij} < Z_j$ and 0 if otherwise. For simplicity, a household i is deprived in indicator j if $g_{ij}^0 = 1$ and $g_{ij}^0 = 0$ if otherwise. The row of the vector of deprivations of household i is represented as g_i^0 and each households deprivation is then weighted (W_j) by the indicators such that $\sum_j W_j = 1$. (4.1).

The deprivation score is then computed for each household as the weighted sum of deprivation as

$$c_i = \sum_{j=1}^{d} W_j g_{ij}^0 \qquad (4.2)$$

where c_i is the number of deprivations suffered by a household i while c is the column vector of these deprivation counts c_i. The variables defining the matrix (X_{ij}) are cardinal, therefore, a matrix g^1 of normalised gaps whose element g_{ij}^1 is defined to be equal to $g_{ij}^1 = \frac{Z_j - X_{ij}}{Z_j}$ when $X_{ij} < Z_j$ and $g_{ij}^1 = 0$ when otherwise.

In general, define g^α whose element $g_{ij}^\alpha = (g_{ij}^1)^\alpha \qquad (4.3)$

The poor are identified using a second cutoff (poverty or across dimension cutoff) denoted by k. This is an intermediate cutoff instead of a union or intersection. The probability for a household to be poor relies on both the 'within dimension' cutoff Z_j and 'across dimension' cut-off k, hence the dual cutoff method of identification used by Alkire and Foster. A household is considered poor if $c_i \geq k$, where k is an intermediate cutoff between 1 and d. To be precise, a household is considered poor when the number of dimensions in which it is deprived is at least equal to k. For the purpose of international comparison, the poverty cutoff (k) will be staged at 0.33, 0.20 to 0.33 for vulnerable to poor households and 0.5 for severely poor households. The deprivation of households that are not classified as poor is censored such that $g_{ij}^0(k) = g_{ij}^0$ when $c_i \geq k$ and $g_{ij}^0(k) = 0$ when otherwise. That is a matrix $g^\alpha(k)$ of any row vector $g_i^\alpha(k)$ of the matrix $g^\alpha(k)$

will have only 0s whenever $c_i < k$. The censored deprivation score is given by

$$c_i(\mathrm{k}) = \sum_{j=1}^{d} W_j g_{ij}^{0}(k) \qquad (4.4)$$

The Adjusted headcount ratio (M_0) measure is the product of the poverty headcount (H) and the average deprivation share among the multidimensionally poor (A).

$$MPI = M_0 = \text{Incidence } (H) * \text{ Intensity } (A)$$

The poverty headcount (H) is mathematically defined as:

$$H = \frac{q}{n} \qquad (4.5)$$

where q is the number of multidimensionally poor households and n is the total population.

Poverty intensity (A) is also defined as:

$$A = \frac{\sum_{i=1}^{n} c_i(k)}{qd} \qquad (4.6)$$

Hence $$MPI = M_0 = HA = (\frac{q}{n})(\frac{\sum_{i=1}^{n} c_i(k)}{qd}) = \frac{\sum_{i=1}^{n} c_i(k)}{nd} \qquad (4.7)$$

The Adjusted Headcount ratio is insensitive when the poverty gap for the poor person rises. Further derivations from the model can be expressed in terms of depth of deprivation and severity of deprivation as illustrated below:

The depth (or intensity) of deprivations which defines a censored matrix $g^1(k)$ as the matrix whose element is equal to $\frac{Z_j - X_{ij}}{Z_j}$ when $X_{ij} < Z_j$ and $c_i \geq k$; and 0 when otherwise. Therefore, MPI in terms of intensity of deprivation is expressed as follows:

$$MPI = M_1 = G * (H * A) = \left(\frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^1(k)}{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^0(k)}\right)\left(\frac{\sum_{i=1}^{n} c_i(k)}{nd}\right) = \frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^1(k)}{nd} \quad (4.8)$$

where the 'average poverty gap' is: $$G = \frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^1(k)}{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^0(k)} \quad (4.9)$$

The severity of deprivation which also defines a censored matrix $g^2(k)$ as the matrix whose element is equal to $\left(\frac{Z_j - X_{ij}}{Z_j}\right)^2$ when $X_{ij} < Z_j$ and $c_i \geq k$; and 0 when otherwise. Hence, MPI in terms of severity of deprivation is shown as:

$$MPI = M_2 = S * (H * A) = \left(\frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^2(k)}{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^0(k)}\right)\left(\frac{\sum_{i=1}^{n} c_i(k)}{nd}\right) = \frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^2(k)}{nd} \quad (4.10)$$

where the 'average poverty gap' is: $$S = \frac{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^2(k)}{\sum_{i=1}^{n}\sum_{j=1}^{d} g_{ij}^0(k)} \quad (4.11)$$

This approach can generally be defined as a "dimension adjusted" poverty measure denoted as M_α.

The MPI approach is used for this study because it is an international measure of acute poverty used by the UNDP to compare different countries' living standards. Moreover, the data collected for the study is consistent with that of the data required to compute MPI. The MPI is compatible with MDGs which is now SDGs and can, therefore, be used as a tool for effective allocation of resources, policy design, identifying interconnections among deprivations, showing impacts over time and complementing other metrics such as income. It is also flexible to use as users can choose dimensions, indicator, cut-offs, and weights that fit their work (Nawar, 2014). The methodology used to evaluate the livelihood situations of the farmer in previous studies is of money-metric nature. This makes the multidimensional index that this study seeks to use the most preferred option.

The standard of living variable measured by the multidimensional poverty index was computed such that it ranges between zero and one. The variable is censored from below since households below the poverty cut-off score 0 even if their score is non-negative. Therefore, the method used for the estimation was Tobit regression model.

4.1.2 The Tobit Model

In the presence of censored data, the Tobit model is the well-known econometric model used. Austin *et al.* (2000) explained that "the Tobit model assumes that the distribution of the response variable, conditional on the explanatory variables is Normal, with uniform variance". He added that "in econometric research, there are frequently subjects for whom we do not observe the true response or dependent variable. For such subjects, all that is known is that the true response, if it had been observed, would have been above, (or below) some threshold". Therefore, we assume that the true model as:

$$M_i^* = \alpha + \beta X_i^* + \varepsilon_i^* \quad (4.12)$$

where M_i^* denotes the individual's poverty status score.

Meanwhile, the individual with an observed poverty status score of 1 has a true $M_i^* \geq 1.0$. Consequently, the observed explained variable is given by $M_i = M_i^*$ for $M_i^* < 1$ and $M_i = 1$ for $M_i^* \geq 1.0$ The actual estimated regression equation will then be given as

$$M_i = \alpha + \beta X_i + \varepsilon_i \quad (4.13)$$

The "ordinary least squares (OLS) estimation of this equation will produce biased and inconsistent estimates of a and b, but, the Tobit model using maximum likelihood estimation produces consistent estimates of a and b" (Austin *et al*, 2000).

4.2 The Empirical Model

Measuring poverty with non-monetary dimensions of well-being serves as a complement to the monetary based measure (Alkire and Santos 2010). The empirical model of this study follows Alkire and Foster (2011). In this case, MPI is used as the dependent variable that measures the impact of CSSVD on the living standards of cocoa farmers in the study area. Specifically, this study adopts the global MPI approach of estimating the level of well-being and the Tobit model to estimate the regression results.

The Tobit model specification can, therefore, be expressed as:

$$M_i = \beta_i Z_i + \varepsilon_i \quad (4.14)$$

where *Mi* is the dependent variable representing the Multidimensional Poverty Index (MPI) of cocoa farmer households. The subscript 'i' denotes individual cocoa farmers' household. Z_i is a vector of exogenous variables, CSSVD Affection (whether a household is affected by Cocoa Swollen Shoot Virus Disease or not), Education level of the household head, occupational diversity, Knowledge of CSSVD, and Cocoa Land Size. Finally, β_i is a vector of unknown parameters and ε_i is the disturbance term.

The global MPI uses 3 dimensions and 10 indicators. However, this study uses the same number of dimensions and indicators but with some modifications. These modifications are seen in the following indicators Housing Condition (Roof type, Floor material, Wall material, Occupancy status) and Water supply or Minutes for fetching Water. The choice of these indicators is based on the availability of data and the nature of the study area which is rural. In addition, the choice is confirmed with international standards, so the same weights are assigned to the dimensions. Table 4.1 presents the various dimensions and the indicators, weights assigned to the indicators, their deprivation cutoffs and their relations to Sustainable Development Goals (SDGs).

Table 4.1: Dimensions, indicators, deprivation, relations to SDGs and weights of the MPI

Dimension	Indicator	Deprived if	Related SDG	Weight
EDUCATION	Enrolment	• school-age child (1 to 8 years) is not attending school in the household	SDG 4	1/6
	Years of schooling	• no person in the household has entered Middle School or JHS	SDG 4	1/6
HEALTH	Child Mortality	• any child (up to 14 years) died in the household	SDG 3	1/6
	Frequency of illness	• household members on average suffer from illness or ill-health quiet frequently (once a month or more)	SDG 3	1/6
STANDARD OF LIVING	Housing Condition	• the main material used for the roof is Branches or grass/thatch **or** • the main construction material used for the floor is mud/clay **or** • the main construction material used for the outer walls is Branches or grass/thatch, mud/clay or wood **or** • the holding/tenancy arrangement of the dwelling is squatting or perching	SDG 11	1/18
	Lighting	• source of lighting for the household is not electricity	SDG 7	1/18
	Cooking Fuel	• the primary source of cooking fuel of the household is collected wood or charcoal	SDG 7	1/18
	Water Supply or Minutes For fetching Water	• the main source of water supply of the household is river **and** • it takes the household more than 30 minutes to access water	SDG 6	1/18
	Toilet Facility	• toilet facility used by the household is not owned and/or shared	SDG 6	1/18
	Household Asset	• the household does not have two or more of durable assets and/or livestock; and land	SDG 1	1/18

Source: Author's illustration from Alkire and Santos, (2011)

The first dimension, education has two complementary indicators, years of schooling and enrolment. Although years of education might not be a good proxy for quality education, level of knowledge attained, skill nor social dynamics, it is a good proxy of functioning that requires

education such as understanding of information, numeracy, and literacy. Again, Enrolment is also a good indicator for exposing school-age children to a learning environment. All household members are said to gain from the abilities of a literate individual in their household (Alkire and Santos, 2011).

For the health dimension, child mortality and the frequency of illness of the household is used. These two indicators are health functioning failure since most of the incidence that causes them can be prevented. Such instances include hygiene, malnutrition among others and these derail welfares of the household.

The third dimension, standards of living, has a wider range of indicators. These can be grouped into housing condition: floor type, roof type, and outer wall type; living condition: cooking fuel, lighting, source of water, toilet facility; living comfort: occupancy status and Minutes for fetching water and Asset: durable and livestock. These standard of living indicators are means to an end (Alkire and Santo, 2011). The housing condition indicators give a good environment for rest and a sound mind. The source of water supply, clean cooking fuel, and improved sanitation are linked to good health. Unsafe drinking water can lead to water-borne diseases, unsafe cooking fuel leads to respiratory and environmental challenges, unimproved sanitation can also lead to disease such as cholera. Hygiene of the household is enhanced by the improvement of these indicators. The availability of light in a household is key for their well-being. A household that has a good source of lighting such as electricity is able to engage in a lot of activities being social or economic. Other factors of social well-being that cannot be underestimated are living comfort. Living a comfortable life reduces current challenges such as stress. This study uses the occupancy status and the minutes for fetching water as a proxy for living comfort. Lots of households in developing communities depend on their asset for survival. For instance, the livelihood of many households rests on a motor

vehicle that works for them. Others also depend on their livestock as an alternative source of livelihood.

The durable assets include land, TV, video deck/decoder/DVD/VCD, radio and recorder, electric/box iron, knapsack sprayer, protective/safety equipment, mobile phone, jewelry. For the purpose of this study, a household possesses other durable if it owns any two of the car, furniture, motorcycle bicycle, tricycle, fridge, gas cooker, sewing machine, fan, motor sprayer, milling machine, water pump machine, desktop or laptop computer, generator, kettle/blender. Livestock includes sheep and poultry. Additionally, a household possesses other livestock if it owns any one of pig, goat, cattle, rabbit, fish farm, grasscutter, bee farm, and mushroom farm.

The indicators discussed above were linked to the MDGs and now SDGs. Improvement in each indicator solves a problem related to the goals set by the UNDP.

The effect of CSSVD on standards of living is indirect. Therefore, this effect of CSSVD is being interacted with household expenditure, which serves as a proxy for household income, to estimate the net effect of the CSSVD on standards of living. The Tobit models for an unconditioned (equation 4.15) and a conditioned (equation 4.16) effect of 'CSSVD Affection' on living standards are specified below. The conditioned model is specified to include interactive and constitutive terms.

$$MPI_i = \beta_0 + \beta_1 CSSVD\_Aff_1 + \beta_2 \ln HHExp_2 + \beta_3 HHH\_EDU_3 + \beta_4 CSSVDKnowledge_4 + \beta_5 OccDiv_5 + \beta_6 CocoaLandSize_6 + \varepsilon_i \quad (4.15)$$

$$MPI_i = \beta_0 + \beta_1 CSSVD\_Aff_1 + \beta_2 \ln HHExp_2 + \beta_3 \ln HHExpCSSVD\_Aff_3 + \beta_4 HHH\_EDU_4 + \beta_5 CSSVDKnowledge_5 + \beta_6 OccDiv_6 + \beta_7 CocoaLandSize_7 + \varepsilon_i \quad (4.16)$$

These estimates follow Brambor *et al*. (2006) with respect to the interaction between CSSVD affection and household expenditure, and test for the joint significance of the interactive terms and the constitutive terms. The hypothesis that the effect of CSSVD on Standard of living as conditioned via household expenditure is tested by the joint coefficients as shown in the equation below.

$$\frac{\partial MPI_i}{\partial CSSVD\_Aff_i} = \delta_1 + \delta_3 \ln HHExp_i = 0 \qquad (4.17)$$

The nature of effect is examined by the summation of the coefficients $(\delta_1 + \delta_3)$ and the test of significance for the joint coefficients.

4.3 Study Variables

Based on the information in Table 4.1 which deals with the dimension and indicators, the variables for the study are selected to be consistent with the literature. The explanatory variables considered in the Tobit regression model include demographic characteristics (education level of the household head); occupational characteristics (occupational diversity); the incidence of CSSVD (CSSVD Affection); and cocoa farm characteristics (Knowledge of CSSVD, Cocoa Land Size). The description of the variables is presented in Table 4.2.

Table 4.2 Description of Variables

Variable	Description
MPI	The MPI is used as the dependent variable to measure the living standards of the cocoa farmer households. It takes a value from 0 to 1.
Log of HH Expenditure (lnHHExp)	Log of Household expenditure is also used as a dependent variable to assess the impact of CSSVD on the income levels of the cocoa farmers.
CSSVD Affection (CSSVD_Aff)	Incidence of CSSVD 0 = Not Affected 1 = Affected
Education Level of HHH (HHH_EDU)	Education level of household head 1 = None 2 = Preschool/Primary 3 = Middle School/JHS 4 = SHS/Vocational/Technical 5 = Tertiary
Occupation Diversity (OccDiv)	Occupation diversity of the household 0 = Does not Occupationally Diversify 1 = Occupationally Diversify
Knowledge of CSSVD (CSSVDKnowledge)	Knowledge of CSSVD 0 = No knowledge of CSSVD 1 = Knowledge of CSSVD
Cocoa Land Size (CocoaLandSize)	Size of cocoa farm land (in acres) own by the household 1 = Below 5 2 = 5 – 10 3 = 11 – 25 4 = Above 25

Source: Author's illustration

4.4 Research Design

The research design comprises of the site location or choice of site, sampling procedure, and size.

4.4.1 Choice of Study Area

The study area, Chorichori community is located near the Sui Forest Reserve in the Sefwi Akontombra district (formerly Sefwi Wiawso district) in the Sefwi Wiawso Traditional Area, of the Western Region of Ghana. The community has a Community-Based Health Planning and Services (CHPS) compound, a basic school, three community boreholes, electricity, a durbar ground, churches, and a mosque. It is about 281 Km away from Accra the capital city.

Figure 4.1 Study Site

Source: Google map

According to the 2010 population census, the total population of Akontombra District was 82,467, comprising of 53,625 (52.9%) males and 39,022 (47.1%) females. The district has a youthful population and its total fertility rate in 2010 was 3.6. The age dependency ratio for the district is 82.8. The climate for the area is tropical with an average temperature of 22 to 27°C and a long-term annual rainfall of 1,461 mm for the period of 1964 to 2001(Boni *et al.* 2004).

The major rainy season spans from the end of March to early July, followed by a short dry season and then a minor rainy season from August to October. The main dry season spans from November to March. This season is characterised by the dry harmattan wind (Schulte-Herbruggen, 2011). Seasonal migration occurs in the district during the peak of the cocoa season. Traders, as well as labour from francophone countries and other regions in Ghana especially labourer in the northern part, come to do business during this period.

This study site was selected mainly because it is cited within the epicenter of the CSSVD and the people in the community have immensely experienced it. Moreover, the location has all the characteristics (climate, soil type, topography, etc) of the suitable cocoa growing areas in Ghana. It is also an existing enumeration area for the Ghana Statistical Service where many studies including Multiple Indicator Cluster Survey (MICS) was conducted in 2017.

4.4.2 Sources of Data

Primary data was gathered to obtain relevant information from cocoa farmers through the administration of structured questionnaires, key informant interviews, and personal observations. The data collected from a household survey comprises of the living standard indicators as well as households' demographic or personal characteristics, capability, economic resource, dwelling-related and ownership of household asset. Data on CSSVD and other farm-related activities have also been gathered. Secondary data was also sourced on cocoa production and cocoa swollen shoot virus disease from the Ghana Cocoa Board (COCOBOD), Cocoa Disease and Pest Control (CODAPEC) office in Sefwi Akontombra; demographic characteristics of the district were collected from the Akontombra District Assembly, Agriculture information from the Ministry of

Food and Agriculture (MoFA) and information on living standards of cocoa farmers, rural and urban dwellers, and Ghana from the various Ghana living standard survey (GLSS) of the Ghana statistical service (GSS).

4.4.3 Sampling Procedure and Size

All households in Chorichori in the Sefwi Akontombra District, as well as hamlets around it were interviewed. One hundred and eighty questionnaires were printed and sent to the study area. The survey covered all dwelling households of the community who are cocoa farmers (both CSSVD affected and non-affected cocoa farmers), other farmers, and non-farmers. The entire population (households) of the community was interviewed but only cocoa farmer households were used as the sample for the study. Out of the hundred (100) households consisting of 412 household members interviewed, eighty-four (84) comprising of 386 household members engaged in cocoa farming.

4.4.4 Analytical Technique

The primary data collected was screened to ensure accuracy, consistency, and reliability. Responses from the questionnaire were extracted and assigned code before data entry. Descriptive analyses, as well as the Tobit regression model, is estimated to determine the living standard of farmers in the prevalence of the CSSV disease.

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 Descriptive Statistics of the Study Variables

The summary of the demographic characteristics of the 84 cocoa farmers' households (hereafter households) interviewed, the occupational characteristics of the study area as well as the incidence of CSSVD and cocoa farm characteristics are presented below.

5.1.1 Demographic Characteristics of the Cocoa Farmers

The majority of the cocoa farmers were males (81%) with female constituting the minority (19%). The age of the cocoa farmers ranged from 22 to 80 years. Nearly 60 percent (59.5%) of these farmers were between the ages of 41 and 65 with an average age of 50.57 years. The results also reveal that the average number of household members of the cocoa farming community is 4.6 ranging from 1 to 13. The majority of the farmers were married (70.2%) whilst the household head's educational level is generally low with only 8.3% that has completed both Senior High/Vocational/Technical (7.1%) and Tertiary school (1.2%). The majority had ended their highest level of education at the Middle or Junior High School (51.2%).

The dominance of male cocoa farmers is because males are often resource endowed than their female counterpart in Ghana and especially in rural areas in Africa. The culture of some African agrarian societies allows women to be marginalized in the possession of and access to information, external inputs, land and other valuable assets (Annag et al. 2011). Again, the nature of farming

comprising smallholder farmers and less of mechanization demands physical strength which may not be in favour of women. The average 51 years old of a cocoa farmer show that the problem that the young people are desisting from engaging in agriculture continues to intensify. The situation is consistent with the finding of Hainmueller, (2011) that many cocoa farmers (40%) would recommend to the children not to follow in their footsteps. Many of the young people are said to have migrated to cities in search of greener pastures.

Majority of the cocoa farmer in the survey had married or are staying with a partner. This could be due to the nature of the work. Farmers need extra labour to support them to work on their farms. This has made it necessary for farmers to secure a partner to help as well as procreate to serve as labour. The results of the study show a low level of education of the cocoa farmers. This confirms the perception that the education level of a farmer in the Ghanaian rural and agrarian societies are low. However, the average cocoa farmers cannot be considered to be illiterate.

An appreciable size of 60.7% cocoa farmers occupationally diversifies with nearly 40 percent (39.3%) who do not diversify. Out of the 100 households interviewed in the community, 84 representing 84% engaged in cocoa farming. Close to 100 percent (96.4%) of those who engage in cocoa farming had it as their main occupation. Only 3.6% engage in both salary and artisanal work with none trading as their main occupation. Household's participation in any off-farm activity accounts for 47.6% whilst Households that exclusively participate in any other farming activity apart from cocoa farming amounted to 35.7%.

Ellis, (1998) defined Occupational diversification as “the process by which rural families construct a diverse portfolio of activities and social support capabilities in order to survive and to improve their standards of living”. In the context of this study, Occupational diversification is defined to include cocoa farmers’ households that participate exclusively in other farm activities such as

cash/tree crop plantation apart from cocoa farming and/or nonfarm/off-farm activities. The poor households in the society turn not to occupationally diversify due to lack of resources such as finance, social and human capital needed to diversify (Guatem and Andersen, 2016). Moreover, the results show that an appreciable number of cocoa farmers diversify. It is therefore expected that this translates into their living standards. The high percentage of the households in the community having cocoa farming as their main occupation signify the good climate and environment for the production of cocoa in the area, hence a reflection in a low standard deviation of 0.445. This helps in easy economic policy making for cocoa farmers. Table 5.1 summarizes the demographic characteristics of the cocoa farmers interviewed.

Table 5.1: Demographic Characteristics of cocoa farmers

Characteristics	Frequency	Percent (%)
Sex of household head		
✓ Male	68	81
✓ Female	16	19
Age of household head		
✓ 18 – 40	23	27.4
✓ 41 – 65	50	59.5
✓ Above 65	11	13.1
Number of household members		
Marital status of household head		
✓ Single	1	1.2
✓ Married	59	70.2
✓ Cohabit	10	11.9
✓ Divorced	7	8.3
✓ Separated	0	0
✓ Widow/Widower	7	8.3
Household head's Education level		
✓ None	19	22.6
✓ Preschool/Primary	15	17.9
✓ Middle Sch./JHS	43	51.2
✓ SHS/Voc/Tech	6	7.1
✓ Tertiary	1	1.2
Occupation Diversification		
✓ No	33	39.3
✓ Yes	51	60.7
Main Occupation (above 15 years) of household head		
✓ Cocoa Farmer	81	96.4
✓ Trader	0	0
✓ Salaried worker	2	2.4
✓ Artisanal Worker	1	1.2

Source: Author's compilation from field data

5.1.2 Incidence of CSSVD and Cocoa Farm Characteristics

In terms of incidence of the CSSVD on the cocoa farms, the survey revealed that 76 out of the farmers interviewed, report of various degrees of incidence on their farms. Thus 27.4% indicated a low incidence, 11.9% reported of high incidence, 34.5% reported very high incidence and 16.7% completely lost their cocoa farm as a result of the disease. This suggests that many of the farms were very highly affected with only about 9.5% being free from the disease.

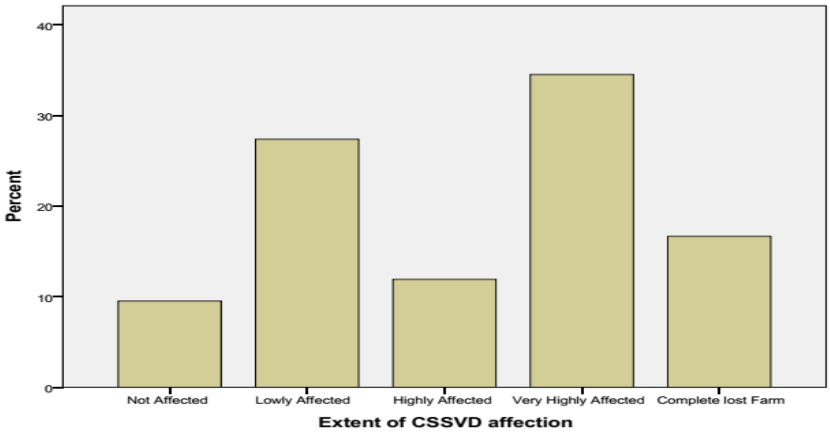


Figure 5.1 Extent of CSSVD Affection

Source: Author's estimate from field data

Having knowledge of an emerging disease is very important for its prevention but ignorance exacerbates the spread of the disease. The result shows that 76 households (90.5%) who had knowledge of the cocoa swollen shoot virus disease and therefore are very eager to prevent it. For cocoa farmland size, only 10.7% of cocoa farmers had above 25 acres. The majority of them had a land size below 25 acres, but in specific, about 30% had a land size below 5%, 33.3% between 5 to 10 acres and 26.2% had between 11 to 25 acres. The summary of these statistics has been captured in table 5.2.

Table 5.2: Statistics of the Incidence of CSSVD on Cocoa Farms

Background Characteristics	Frequency	Percent (%)
Affected by the CSSVD		
✓ No	8	9.5
✓ Yes	76	90.5
Extent of CSSVD affection		
✓ Not Affected	8	9.5
✓ Lowly	23	27.4
✓ Highly	10	11.9
✓ Very Highly	29	34.5
✓ Completely Lost	14	16.7
Knowledge of CSSVD		
✓ No	8	9.5
✓ Yes	76	90.5
Cocoa land size (in acres)		
✓ **Below 5**	25	29.8
✓ **5 – 10**	28	33.3
✓ **11 – 25**	22	26.2
✓ **Above 25**	9	10.7

Source: Author's compilation from field data

"Cocoa trees, like other crops, are susceptible to a number of diseases and pests that affect the yield of pods from the trees" (Kongor *et al*., 2017). CSSVD is of no exception to this stance. The study revealed that a greater number of households were very highly affected. This obviously reflects a reduction in their annual yield and then reduces their annual profit. Having knowledge of plant disease is very important to curtail it in the early stage. Many of the households (90.5%) had knowledge about the CSSVD. The medium through which they got to know about the disease was mainly through the radio (30.3%) or extension officers (50.0%). The main challenge was that they seldom access extension service in the community. About 77% of the farmers claimed that it sometimes takes more than a year to access extension service. The small acres of land cultivated by the cocoa farmers are in line with the fact that the majority of Ghanaian farmers are subsistent and smallholder farmers. Farmers' cooperative or Associations play a very important role in the

success of farming in every society. These cooperatives educate the member on new agricultural practices and technologies. Meanwhile, only 17.9% of any member of a cocoa farmer household interviewed associate themselves with such groups. By the way, this is an improvement on the finding of Hainmueller, (2011) that saw less than 10% of farmers in farmers' association.

Many studies (Larson *et al*., (2005), Teal *et al*., (2006), Kongor *et al.,* 2017) have concluded that fertilizer and other farm inputs such as agrochemical play a critical role in attaining a higher yield in cocoa production. The findings of the survey, however, show that 77.4% of the cocoa farming households do not have access to fertilizer. Due to this, 78.6% did not apply fertilizer during the year. Again only 46.4% have access to other agrochemical inputs such as fungicide, weedicides, and insecticide. Henceforth, a little over 40% apply these chemicals quite frequently. Accessing labour in the study area depends on the particular season of the year. Labour is always available during the cocoa lean season. It is also available when it is not time for new farming. Employers of labour suffer a lot to access labour when these two periods elapse since all the labourers ("By-day workers" and "Apaafour") go to work on their farms.

The study recorded that 79.8% of households use external labour force whereas 69.7% of them have access to these labour force. Accessing water for farm activities such as spraying and irrigation cannot be undermined. All 76.2% of households who have access to water in their cocoa farm draw from rivers or lakes. Nearly a quarter of them have to travel long distances to access water. It very appalling that the agricultural sector that employs about 50% of Ghanaians always suffer to access credit facility. The results of the survey did not indicate any difference. Only 3 out of 84 households claim they have access to credit facility. Just one of these three households accesses credit from the bank.

5.3 The Regression Estimates

This subsection discusses the results derived from the outcome of the Tobit regression analysis presented in Table 5.3.

Table 5.3: Regression Estimates of the Standard of Living

Model	Unconditional Model		Conditional Model	
	Std. coef. (β)	p=value	Std. coef. (β)	p=value
C	**.4317679**	**0.000**	**-0.7439362**	**0.282**
CSSVD_Aff	**.0222948**	**0.742**	**1.231307**	***0.082**
lnHHExp	**.0131656**	**0.209**	**0.1317991**	***0.076**
HHH_EDU	**-.059238**	****0.000**	**-0.0624196**	****0.000**
CSSVDKnowledge	**-.1423429**	****0.001**	**-0.1350313**	****0.002**
OccDiv	**-.0567688**	***0.054**	**-0.0596568**	**0.037**
CocoaLandSize	**-.0254776**	***0.055**	**-0.0268209**	**0.045**
lnHHExpCSSVD_Aff			**-0.1211684**	**0.101**
Net Effect			**1.231307**	***0.078**
F - value (7,77); (6,78) = **5.69; 6.81**		****0.000**		****0.000**
Pseudo R sq.		**-0.4246**		**-0.4748**
Log pseudolikelihood		**50.446**		**52.223**
Obs. (Households) n = **84**				

***p<0.01, **p<0.05, * p<0.10

Source: Author's estimation from field data

5.2.1 Discussion of Regression Results

Table 5.3 presents the findings from both the conditional and unconditional effect of the prevalence of cocoa swollen shoot virus disease on the standard of living of cocoa farmers measured with a multidimensional poverty index. The F-value of 5.69 is statistically significant ($P<0.01$). This indicates a combined influence of all significant variables on the multidimensional poverty index (MPI). The Tobit model estimation has been robust to correct heteroscedasticity.

The Incidence of Cocoa Swollen Shoot Virus Disease

The approach of Brambor *et al.* (2006) is followed in terms of the conditional effect of 'CSSVD Affection' on living standards through household expenditure. The joint significance of the interactive term and the constitutive term is first tested in each model and the net effect computed as shown in Table 5.3. In the unconditioned model, the occurrence of the cocoa swollen shoot virus disease (CSSVD Affection) and household expenditure were not significant. However, they were both significant at the 10% level ($P<0.10$) and positively related to MPI in the conditional model. This implies that while the disease does not directly affect the living standard of the households of the cocoa farmers as shown in the unconditional effect model, the disease significantly and positively affected the MPI of the cocoa farming households in the conditional model.

It can be observed from the conditioned results that the joint significance of the interactive term and constitutive term are significant for the standard of living indicator. This implies that the conditioning of CSSVD on household expenditure is appropriate for the MPI. The results also

indicate that the net effect of CSSVD and household expenditure on MPI was significant when CSSVD was conditioned on household expenditure. Thus, the net 'CSSVD Affection' and household expenditure on multidimensional poverty index is 0.078 which is a tremendous improvement of the direct effect of CSSVD Affection on MPI (0.742). Again, the net effect of CSSVD and household expenditure negatively affect standards of living (increases multidimensional poverty deprivation). This finding implies that CSSVD affects standards of living indicators through household expenditure which serves as a proxy for income. Thus, the disease reduces the living standards of farmers through their income. When the cocoa farm of a household contract cocoa swollen shoot disease, their expenditure level decline which intern affects their standard of living through poverty deprivation.

These findings are consistent with prior studies that show that plant disease reduces crop production. However, this study additionally shows the mechanisms through which the disease affects standards of living. The incidence of CSSVD like any other disease such as the pink disease, black pod disease among other obviously leads to a significant decline in cocoa production (Akrofi *et al*., 2014, Kongor *et al*., 2017, Teal *et al*., 2006). Nonetheless, the result indicates that cocoa swollen shoot virus disease does not directly impact on living standards measured in a multidimensional context. Rather, place of residence, public life, economic area, interpersonal relations, health care, personality, and environment among other are the factors that may directly determine the living standards of households in the community (Birčiaková and Straka, 2015).

The results of the control variables used are similar for both the unconditional and the conditional models. Nonetheless, for the purpose of this study, the results of the conditional model are used to discuss them.

Occupation Diversity

Occupation Diversity negatively influences MPI and the estimated coefficient is significant at 5 percent level with the negative standard coefficient of 0.037. A household which occupationally diversifies reduces its deprivation status by 5.97%. The significance of occupational diversity confirms the position of many studies which holds that diversified households improve upon their standard of living (Gautam and Andersen, 2016; Ampaw *et al*. 2017; Schilte-Herbruggen 2011 and Asmah, 2010).

Other Determinants

Education Level of household heads and Knowledge of CSSVD were negative and statistically significant at 1 percent level. The large negative effect of education and knowledge of CSSVD with coefficients, 0.0624 and 0.135 imply that both measures have a higher impact on MPI than the other variable. A unit increase in the household heads' education level reduces multidimensional deprivation by 6.24%. Again, a unit increase in the households' knowledge of the CSSVD reduces the multidimensional poverty of the household by13.5%. Education is said to enhance farmers understanding of new technologies as well as their knowledge of cocoa production and its management practices. Having knowledge of the disease will give the household the capability to effectively manage the disease with the necessary strategies. A household that has a higher level of education, as well as knowledge of the disease, has built upon their capabilities, which reflects in their standard of living.

The results also show an inversely significant relationship between Cocoa Land Size and MPI at 5% level (0.045) with a coefficient of 0.0268. Its negative effect means MPI decreases as cocoa land size increases. This implies that as a household cocoa land size increases, its standard of living improves. On the contrary, the findings of Kongor, (2017) revealed that, if the size of cocoa farm increases, the productivity decreases. The low production resulting from larger cocoa land sizes may be that as the cocoa farm increases, the more difficult it is for maintenance and therefore a positive impact depends on good management practices.

Indeed, the findings of the study is consistent with the school of thought that it is not appropriate to measure standard of living or welfare with a money-metric measure such as consumption, income or expenditure (Sen, 1993; Erikson and Aberg, 1987; Statistics Sweden, 1996; Australian Bureau of Statistics, 1998; Fergusson *et al.*, (2011); UDHR; ICESCR). The incidence of CSSVD only directly affected the money-metric measure of standard of living but did not directly impact the multidimensional aspect of standard of living.

5.3 The Multidimensional Poverty Index

The Multidimensional Poverty Index was computed in line with the Global multidimensional poverty index that was propounded by the Oxford Poverty and Human Development Initiative (OPHI). Based on the 84 households, interviewed, the multidimensional poverty index ranged from 0.056 to 0.611 with the mean and standard deviation of 0.225 and 0.144 respectively**.** It shows that poor households in the study area are deprived in 22.5% of the deprivations that would be experienced if every person in the area was poor and deprived in all indicators.

5.3.1 The Multidimensional Poverty of Cocoa Farmers Based on Cut-Offs

This subsection presents the results of households defined as poor on the basis of at least *k* indices. In this study, *k* represents the cutoff at which a household is defined as deprived at various levels. The study uses ten indicators and three dimensions which define ten different cut-offs for the weighted indicators. This approach is consistent with Deutch and Silber (2005) attempt to compare four approaches using 1995 Israeli Census.

The results in Table 5.5 indicate that 85.71% of the households representing 72 households were deprived in at least one (k=1) indicator with 12 households not deprived in any indicator. As the cut-off increases, the number of households deprived of the various indicators decreases. Poverty level MPI_6 indicates that only one household (1.19%) is deprived in at least six (k=6) indicators. Cut-off points after k=6 are not considered relevant because no household is deprived.

Table 5.4: Deprivation Rates and Cut-offs of Indicators of Cocoa Farmers

Poverty level	**MPI_1**	**MPI_2**	**MPI_3**	**MPI_4**	**MPI_5**	MPI_6	**MPI_7**
Cut- off (k)	1	2	**3**	4	**5**	6	7
Frequency	72	42	**19**	14	**5**	1	0
Percent (%)	85.71	50.00	**22.62**	16.67	**5.95**	1.19	0

Source: Author's compilation from field data

According to OPHI (2017), "a person is identified as **multidimensionally poor** or 'MPI poor' if they are deprived in **at least one-third** of the weighted indicators shown above; in other words, the cut-off point for poverty (k) is **33.33%"**. Moreover, "If a person is deprived in **20-33.3%** of the weighted indicators they are considered **'Vulnerable to Poverty'**, and if they are deprived in **50% or more** (i.e. $k \geq 50\%$), they are identified as being in '**Severe Poverty**'".

Adopting these definitions, a household will be MPI poor in Table 5.5 from the cut-off of k=3 and severely poor from k=5.

The results in Table 5.6 show that with a cut-off of k = 33.33%, the study reveals that 22.62% of households (19 households) are deprived in at least a third of the weighted indicators. The results further showed that at k = 20 – 33.33% cutoff, 27.38% of households (23 households) were considered vulnerable to poverty. Finally, at k = 50% cutoff, only 5.95% of households (5 households) were severely deprived. These findings can be explained in relation to the OPHI survey for Ghana in 2017 which used the same approach.

Table 5.5: Survey MPI Results at Various Cutoffs

Poverty Levels	Cut off (k) (%)	Frequency	Cocoa Farmers (%)
MPI Poor	33.33	19	22.62
Vulnerable to poverty	20-33.33	23	27.38
Severe poverty	50	5	5.95
MPI			0.225*

Source: Author's Data and OPHI Country Briefing 2017 (Ghana); *not in percentage

The study shows that 22.62% of cocoa farmers are MPI poor and 5.95% are severely poor. In relation to the OPHI country estimates for Ghana, 49.4% are MPI poor while 21.0% are in severe poverty which is clearly above the estimates of this study. This implies many cocoa farmers have a better standard of living than other Ghanaians in rural communities and Ghana in general. Additionally, cocoa farmers seem to be vulnerable to poverty with MPI of 27.38% according to estimates from this study, compared to OPHI estimates which revealed that 20.7% of rural Ghanaians are vulnerable to poverty as well as 23.0% of general Ghanaians. Moreover, the MPI of the study stood at 0.225, below that of rural areas (0.235) but higher than the national MPI

(0.156). Finally, the percentage of MPI poor cocoa farmers is also below the percentage of poor Ghanaians (24.2%) using the national poverty line (2012) (GSS, 2014). Many cocoa farmers from the survey are therefore better off.

5.4 Summary of Main Findings

The cocoa swollen shoot virus disease is still an endemic disease drawing back cocoa production in the world, particularly in Ghana. The finding from the study clearly shows that the prevalence of the swollen shoot virus disease in cocoa growing areas impact on living standards of farmers measured in a multidimensional context through the expenditure levels of households whose farms are affected by the disease. Moreover, households that engage in other activities in addition to exclusively engaging in cocoa farming significantly improve their living standards. Likewise, households whose head have a higher level of education and those that have knowledge of the disease have higher living standards. The cocoa land size of a household also has a significant impact on standards of living. Finally, the multidimensional index shows that cocoa farmers are multidimensionally better off than rural dwellers and Ghanaians in general.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study seeks to find out how the prevalence of cocoa swollen shoot virus disease has impacted on the living standards of the affected cocoa farmers. Specific objectives are to determine the extent of the current state of the spread of the CSSVD and examine alternative livelihood strategies adopted by the cocoa farmers as a result of the prevalence of the disease.

This study, therefore, adopts the multidimensional approach to measure standards of living since it comprehensively measures all the necessary aspect of human well-being. The global multidimensional poverty index which is one of the approaches propounded by Oxford Poverty and Human Development Initiative (OPHI) and used by UNDP to measure the deprivation levels of countries is used in this study to measure the living standards of the cocoa farmers. The multidimensional poverty index (MPI) uses three dimensions (education, health, and standard of living) and ten indicators. For the purposes of this study, three dimensions (education, health and standard of living) and ten indicators including child school enrollment, Years of schooling, Child mortality, Frequency of illness, Housing conditions (Roof type, Floor material, Wall material, Occupancy status), Lighting, Cook fuel, Water supply or Minutes for fetching water, Toilet facility, Household asset are used.

In executing this study, Chorichori, a community in the Sefwi Akontombra District in the northern part of the Western Region which is the epicenter of the disease is considered. A structured questionnaire was used to gather a field data from cocoa farmers' households in the community to

determine the household level multidimensional poverty index and the impact of the incidence of CSSVD on the socioeconomic well-being of the cocoa farmers.

Tobit regression models are estimated to evaluate the impact of the incidence of CSSVD on the standard of living of the households which in this study is the Multidimensional Poverty Index (MPI). Variables considered in the models include demographic characteristics (education level of the household head); occupational characteristics (occupational diversity); the incidence of CSSVD (CSSVD Affection); and cocoa farm characteristics (Knowledge of CSSVD, Cocoa Land Size).

The findings of the study indicate that cocoa swollen shoot virus disease does not directly have an impact on the living standards of households especially those in Chorichori in the Sefwi Akontombra District of the Western Region, the study area. The cocoa swollen shoot virus disease rather had an impact on standards of living through the household expenditure, which serves as a proxy for income. This implies that the incidence of cocoa swollen shoot virus in the region affected their cocoa production levels which intern reduce their low income and resulting in low living standards. Meanwhile, their low-income level does not necessarily mean they are multidimensionally poor or have low living standards since the analysis of the MPI indicates a better living standard for many affected cocoa farming households than many rural dwellers and Ghanaians in general.

Having an alternative livelihood measured in this study as occupational diversity has a negative effect and significant impact on multidimensional poverty. Households that diversify have an improved standard of living.

The study also reveals key findings of other determinants in the model to estimate the impact of CSSVD on standards of living (MPI) of households. Educational level of the household head and Knowledge of CSSVD have a negative effect and significant impact on multidimensional poverty of households. A high level of education and knowledge of CSSDV indicates a high standard of living. Cocoa Land Size of households has a significant impact on multidimensional poverty. The welfare levels of the households depend on the size of their cocoa farm.

Based on OPHI definitions, the percentage of households that were multidimensionally poor and severely poor was less than the percentage of people who are multidimensionally poor nationwide and in rural communities hence many cocoa farmers' households are multidimensionally better off than many Ghanaian households in general. On the other hand, cocoa farmers' households are more vulnerable to poverty than rural dwellers and Ghanaians at large. Hence, any unfortunate incidence in the cocoa sector is likely to land cocoa farmers at a lower level of standard of living than another rural dweller who engages in other activities other than cocoa farming. Additionally, the percentage of MPI poor cocoa farmers' households in the survey is still less than the percentage of poor Ghanaians using the national poverty line.

Male cocoa farmers still dominate in the cocoa farming industry. The age group that engages much in cocoa farming is those above 40 years. Due to the nature of the work, a large number of farmers are either married or staying with a partner. The survey indicates a low level of education of the household heads of Middle or Junior high School. The majority of the cocoa farmers interviewed have cocoa farming as their main occupation. Nonetheless, an appreciable number of the households occupationally diversify. Although most of the households have knowledge of the CSSVD, a very high percentage (90.5%) had their cocoa farms affected by the disease and a large number of them were very highly affected.

The main challenges of the households include access to extension service, credit facility, inputs such as fertilizer and agrochemicals. A major improvement will be realized if the various household can have access to these needs. Access to labour depends on the farming season. Majority of the cocoa farmers depended on rivers and lakes close to their farms for their farm activities. A very small percentage of households were members of a farmer's cooperative. This contributes to the numerous challenges in the sector since they are not able to come together to pursue their needs. Majority of cocoa farmers own less than 10 acres of land. This contributes to the low-income level of a cocoa farmer in Ghana.

In conclusion, the incidence of the CSSVD like any other crop disease determines and impacts significantly on the standard of living of affected farmers if it is conditioned via their lower income (household expenditure), which result from low yield but does not directly influence their standard of living measured in a multidimensional context. Moreover, households which diversify improve upon their livelihood than those who do not.

6.2 Policy Recommendations

In view of the research findings, for cocoa farmers to improve upon their livelihood, the following recommendations are offered for policy formulation.

Education levels in cocoa growing areas are low. However, the living standards of these households largely depend on their level of education. There is, therefore, the need to sensitize young people in these areas who will potentially take over cocoa farming to attain higher levels of

education. Again, the government should provide all the necessary facilities for education in these areas to thrive.

Households with high knowledge of the CSSV disease have the privilege to manage and prevent its incidence as well as have a high standard of living. The work of extension officers was very key in curtailing the spread of the CSSVD in the district. Only a few extension officers who handle over seventeen (17) communities each in the Sefwi Akontombra district. The government should employ extension officers with immediate effect to take control of the situation at hand. If possible every farming community with a sizable population should have an extension officer to teach them how to deal with diseases such as this.

Some farmers only depend on their cocoa production for their livelihood without any other work. In situations such as the occurrence of the CSSVD, they tend to financially suffer more. Social amenities such as good roads, electricity, schools, small and medium enterprises, and social interventions should be made available to rural communities where agriculture is practiced. The government can liaise with banks and Ghana COCOBOD to extend credit facility to cocoa farmers and deduct at source when these farmers sell their cocoa produce. These will give them the needed business environment to diversify their occupation.

There have been various recommendations for the management of the disease. Stakeholders such as COCOBOD, farmers, and CRIG should intensify their roles in dealing with the disease.

Finally, Challenges such as accessing inputs such as fertilizer, agrochemicals, Credit facility and social amenities that has been a challenge from time immemorial should be addressed to improve upon the cocoa farmers' well-being.

6.3 Directions for Further Research

Further research is required in the area of cocoa farmers' well-being.

This study could not cover a large area of cocoa farming in the country. A national survey to collect data on the disease across the country and its impact on the farmer should be embarked upon when resources are made available.

Also, further research should look at other approaches to analyse standards of living differently from the Multidimensional Poverty Index due to its arbitrariness or subjectiveness in determining a cutoff for its indicators. This will ensure an unbiased approach to setting the cut-offs and reduce the arbitrariness.

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APPENDIX

Questionnaire:

DEPARTMENT OF ECONOMICS

UNIVERSITY OF GHANA, LEGON

Date: ……

Dear respondent,

COCOA SWOLLEN SHOOT VIRUS DISEASE (CSSVD) AND THE LIVING STANDARDS OF COCOA FARMERS: EVIDENCE FROM CHORICHORI IN THE SEFWI AKONTOMBRA DISTRICT OF GHANA

I am a graduate student from the Department of Economics, University of Ghana, Legon. I would like to interview you to enable me to collect the necessary information to complete my MPhil Economics research on the above topic.

All information provided in this questionnaire will be treated as confidential and your anonymity is assured. Thank you for your time and cooperation.

S. YAW AGYEMAN-BOATEN

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(0241032594/0271032594)

QUESTIONNAIRE

Household code: ……..……..

Respondent ID: ……..……

Section A: Household Demographic/Personal Characteristics

ID of HH members	Relation to head of HH (A)	Marital status (B)	Sex (C)	Age	Education level (D)	Religious denomination (E)	Main Occupation (15-64 years) (F)	Migration status of HH (G)
01	Head							
02								
03								
04								
05								
06								
07								
08								
09								
10								

(A) 1 = Head 2 = Spouse 3 = Son or Daughter 4 = Grandchild 5 = Other relative 6 = Non relative

(B) 1 = Single 2 = Married 3 = Cohabit 4 = Divorced 5 = Separated 6 = Widow/Widower

(C) 1 = Male 2 = Female

(D) 1 = None 2 = Primary/Preschool 3 = Middle Sch./JHS 4 = SHS/Voc./Tech 5 =Tertiary

(E) 1 = Catholic 2 = Protestant 3 = Pentecostals/Charismatic 4 = Other Christians 5 = Islam 6 = Traditionalist 7 = No Religion 8 = Other, specify …….

(F) 1 = Farmer 2 = Trading 3 = Salaried Work 4 = Artisanal work 5 = Other, specify.……

(G) 1 = Indigenes 2 = Settlers

Section B: Capability

Education

1. What is the highest level of education of the household head?

   ☐None ☐Primary ☐ Middle School/JHS ☐SHS/Voc./Tech ☐Tertiary

2. Is there any school-age child (1 to 8 years) who is not attending school? ☐ Yes ☐ No
   If yes, what is the reason?

☐ Lack of parental interest ☐ Lack of interest by child ☐ School too far away ☐ Inability of parents to fund child's education ☐ Dangers faced by children on their way to school (eg. getting drowned in rivers) ☐ Children are used for work ☐ Other, specify……..……..

Health

1. Has any child (up to 14 years) died in the household in the last 12 months? ☐ Yes ☐ No
2. Has the household's child (up to 5 years) ever been immunized? ☐ Yes ☐ No
   If yes, were any of these immunizations given to the child during the past 12 months?

   ☐ Yes ☐ No ☐ Do not know ☐ Not applicable
3. How frequently do the household members on average suffer from illness or ill-health?

   ☐ Quite frequently (once a month or more) ☐ Not so frequently (about once in 3 months) ☐ Not at all/very rarely (once a year or less)
4. Does the household have access to health care services? ☐ Yes ☐ No

Section C: CSSVD and Farming

1. Does the household own a cocoa farm? ☐ Yes ☐ No
   If *yes*, what is the size of cocoa farmland owned in acres?

   ☐ {Below 5} ☐ {5 - 10} ☐ {11 - 25} ☐ {Above 25}
2. Does the household exclusively participate in any other farming activity apart from cocoa farming? ☐ Yes ☐ No [*If Q1 & 2 are No >>> Q11*]
   If yes, what is this other farming activity?

   ☐Rice ☐Vegetables ☐Oil Palm ☐Cashew ☐ Animal rearing ☐ Other (Specify).……
3. Do you have knowledge about the CSSVD? ☐ Yes ☐ No
   If yes, by which medium did you hear about it?

   ☐ Relatives/Friends ☐TV ☐Radio ☐Extension officers ☐Other (Specify)……..

4. Has the household been affected by the CSSVD? ☐ Yes ☐ No
   If *yes*, to what extent has the household been affected?

   ☐Lowly affected ☐Highly affected ☐Very highly affected ☐Complete lost farm

5. Does the household have access to extension officers? ☐Yes ☐No
   If yes, how often does the household receives the service of these extension officers?

   ☐Quite frequently (once in a month or more) ☐Not so frequently (about once in six months) ☐Rarely/ Not at all (once in 12 months or less)

6. Does the household use external sources of labour force? ☐Yes ☐No

   If yes, does the household easily have access to this form of labour force? ☐Yes ☐No

7. Does the household have access to fertilizer? ☐ Yes ☐No

   If yes, how many 50kg bags per year? **.....**

8. Does the household have access to farm inputs (such as insecticides, weedicides, etc)?

   ☐ Yes ☐ No
   If yes, how often do you apply these inputs to your farm?

   ☐ Quite frequently (once a month or more) ☐ Not so frequently (about once in 3 months) ☐ Not at all/very rarely (once a year or less)

9. Does the household have access to water for farm activities? ☐Yes ☐No

   If yes, what is the source? ☐Rainwater ☐River/Lake ☐Well ☐Other, specify……..

10. Does a household member belong to any farmer cooperative union or group?

    ☐Yes ☐No

11. Does the household head participate in any off-farm activity? ☐ Yes ☐ No
    If *yes,* which type of off-farm activity?

    ☐ Artisanal work ☐ Trading ☐ Salaried Work ☐ Other, specify
    ……

12. Does the household have access to financial credit? ☐Yes ☐No
    If yes, by what means?

    ☐Bank ☐Credit Society ☐Private lenders ☐Relatives/Friends ☐Other (specify) ……

Section D: Economic Resource

HH Member ID	01	02	03	04	05	06	07	08	09	10	Total
Non-food expenditure for the last 12 months (Cloths, footwear, culture and T & T)											

[*In order to get an accurate recall, one should preferably ask non-food expenses per month and further by providing reference points*]

1. What is the household's food expenditure for the last one week? …….
2. Can the household afford eating meat, chicken or fish every day, if wanted? ☐Yes ☐No
3. Can the household afford to buy new rather than second-hand clothes? ☐Yes ☐No

Section E: Dwelling- Related Indicators

1. What is the household's Dwelling locality?

   ☐Within the Community ☐ In a nearby Cottage
2. What is the household's present holding/tenancy arrangement of the dwelling?

   ☐Owning ☐Renting ☐Rent-free ☐Perching ☐Squatting
3. How many rooms does this household occupy (Include detached rooms in the same compound if same household; count Living rooms, Dining rooms, Bedrooms But Not Bathrooms, Toilet & Kitchen)? **……**
4. What is the main material used for the roof?

   ☐Branches or grass/thatch ☐Wood/Bamboo ☐Cement/Brick/Tiles ☐ Asbestos/Slate

   ☐Iron Sheets
5. What is the main construction material used for the floor?

   ☐Cement ☐Fiber-glass ☐Stone ☐Wood ☐Mud ☐Other, specify ……
6. What is the main construction material used for the outer walls?

☐Concrete/cement blocks ☐Metal sheet/slate/asbestos ☐Bricks ☐Wood ☐Clay

☐ Branches or grass/thatch

7. What is the source of lighting for the household?

   ☐ Electricity ☐Generator ☐Flashlight/Torch ☐Kerosene lamp/lantern ☐Candle

   ☐Other, specify……

8. What the primary source of cooking fuel of the household?

   ☐Collected wood ☐Charcoal ☐Kerosene ☐Gas ☐Electricity ☐Other, specify……

9. What is the main source of water supply of the household?

   ☐ River ☐Public well ☐Public borehole ☐ Public piped water ☐Other, specify……

10. How long does it take the household to access water (in minutes)?

    ☐ {Below 10} ☐ {10 – 20} ☐ {21 - 30} ☐ {31 - 60} ☐ {Above 60}

11. What type of toilet facility is usually used by the household?

    ☐No facility ☐Public pit latrine ☐Own pit latrine ☐Pan/Bucket ☐KVIP ☐W. C

Section F: Asset-based indicators

Number of selected assets owned by the household

Code	Asset type	1 = Yes 0 = No	Number owned (if Yes)
1	Land (Acres)		
2	Furniture		
Livestock			
3	Cattle		
4	Sheep		
5	Goats		
6	Pigs		
7	Poultry		
8	Rabbits		
9	Fish Farming		
10	Snail Farming		
11	Grasscutter		
12	Bee Hives		
13	Mushroom		
Transportation related-assets			
14	Cars		
15	Motorcycles		
16	Bicycles		
17	Tricycle		
Appliance and electronics			
18	Television		
19	Video deck/VCD/DVD player/Decoder		
20	Refrigerators/fridge		
21	Electric/gas cookers		
22	Sewing machines		
23	Radios/Recorder/Home theatre		
24	Fans		
25	Electric/Box iron		
26	Knapsack sprayer		
27	Motor sprayer		
28	Milling machines		
29	Water pumping machine		
30	Protective clothing/Safety equipment		
31	Desktop/laptop computer		
32	Mobile phone		
33	Generator		
34	Electric Kettle/Blender		
35	Jewelry		

Akontombra District Map

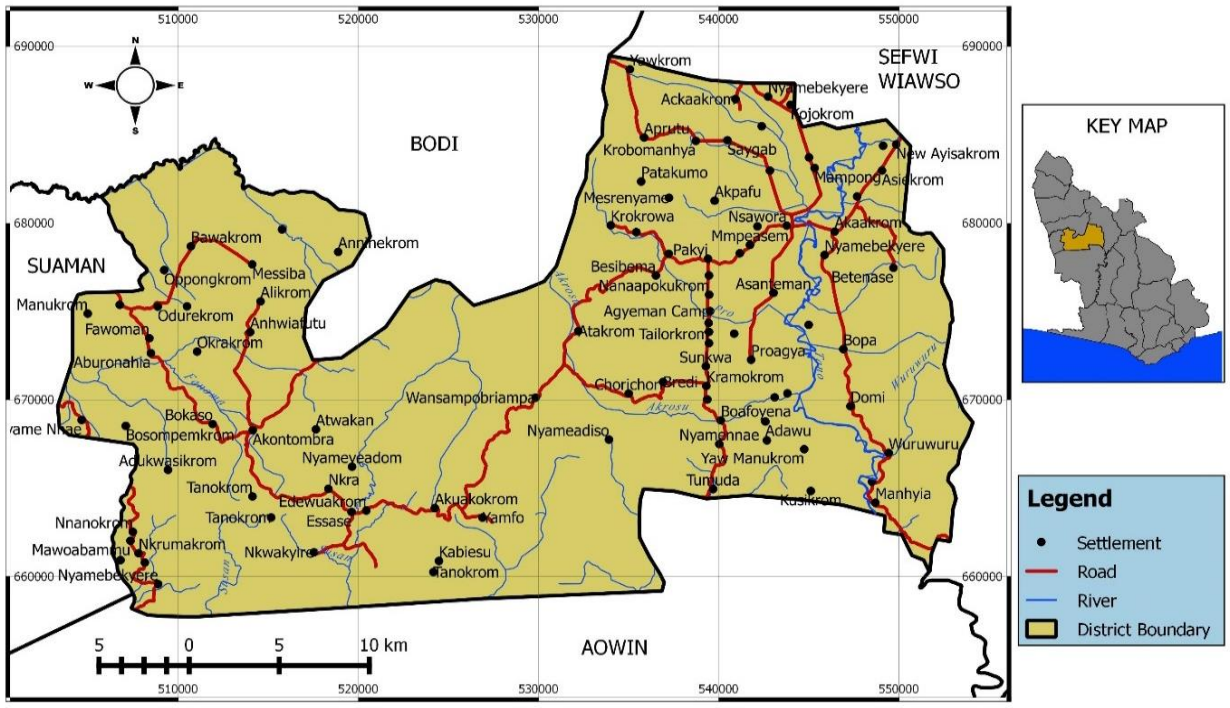

Photo of CSSVD Infected Farm