FACTORS AFFECTING ADOPTION OF HAND POLLINATION TECHNIQUE BY COCOA FARMERS IN ONDO STATE OF NIGERIA

BY

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DEDICATION

This project is dedicated to the God Almighty, the Alpha and the Omega of my life. My wife (Mrs Olaitan Amanoshi), my children (Agape and Ark) and my Late Grand Mother, Mrs Olaitan Olabisi.

CERTIFICATION

I certify that Mr. Olaitan A. A. of the Department of Agricultural Extension and Communication Technology, Federal University of Technology, Akure, Ondo State, Nigeria, carried out this project work under my supervision.

_____ _____

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ABSTRACT

The study was designed to investigate factors affecting adoption of hand pollination technique by cocoa farmers in Ondo State. Specifically, the socio-economic characteristics of respondents were examined, the information sources by which they become aware of improved technologies and hand pollination technique were ascertained, the study also identified the production strategies used by the cocoa farmers in the study area; the constraints of adoption of hand pollination technique by the farmers were determined. It also identified the factors that enhanced the adoption of hand pollination technique. The study used a well-structured questionnaire which was administered to 100 respondents randomly selected from two local government areas in Ondo State, that are prominent in using hand pollination technique. The stastitical tools used for data analysis include frequency, means and percentage, multiple regression, logistic regression and chi-square. The result showed that 30.0 percent of the respondents were at the age of 51 – 60; about 90.0 percent of the respondents were male. The result further revealed that twenty five percent of the respondents (25.0 percent) completed secondary school; 56.0 percent of the respondents had over 25 years' experience in cocoa production and 47.0 percent of the respondents made an average income of between N1m – N1.99m and above annually; the respondent that realized four tonnes harvest yearly were 34.0 percent. The result showed that 55.0 percent of the respondents were aware of hand pollination technique although, all of them agreed to decline in cocoa production. All the respondents were positive to the statement that old age of cocoa farms affects

cocoa production output, 53.0 percent strongly agreed with this while 47.0 percent agreed but none had a contrary opinion. Seventy three percent of the respondents strongly agreed with the fact that hand pollination is easy to use. Multiple regression analysis revealed that annual income of the farmers, level of education, years of experience; cocoa farmer size and household size are socio-economic factors that influence adoption of hand pollination. Stepwise logistic regression showed that annual income, source of capital, age of the farmers, farmers output and types of crop were significant which are likely to influence the adoption of hand pollination technique. I therefore, recommended that effort should be made by government, non-governmental organization (NGO's) private organization and agro-industries in providing credit facilities, effective extension services, inputs supply and delivery system so as to make farmers adopt new technique being introduced to them.

TABLE OF CONTENTS

CHAPTER THREE

CHAPTER FOUR

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Impact of Agriculture on the Economy of Nigeria

The importance of agriculture in any country cannot be over-emphasized as this provides the source of sustenance for human lives in terms provision of food, employment among others. Apart from the fact that agriculture provides food from crops, livestock and fisheries, it is also the source of raw materials for industries. In addition to this, it equally provides employment to a substantial number of people in the rural areas .The agricultural history of Nigeria is intertwined with its political history. This can be assessed from the pre-colonial, colonial and post colonial periods. Before the British conquest, the pre-colonial society strived on agriculture as the main stay of the traditional economy.

The importance of agriculture in the Nigeria economy hardly needed stressing. Agriculture was the main stay of the economy before the discovery of petroleum in commercial quantities in Oloribiri in 1957 and the subsequent export of the commodity in 1958. Agriculture accounted for about seventy percent of the national income in the pre-independence era and for about sixty five percent in the first four or five years of the post-independence period (Kayode and Usman, 1985)

In terms of employment, agriculture is by far the most important sector of Nigerian economy. Nigeria's soils and climate allow cultivation of a wide variety of food crops like cassava, millet, sorghum and cash crop like Cocoa, groundnut e.t.c (which use to be Nigeria economic pride among countries of the world). Agriculture is Nigeria biggest employer accounting for about 60 percent of the work force, working mainly in small holdings using basic

tools. Together with livestock raising, it provides a thirds of the Gross Domestic Product(Africa Recovery, 1999).

Agricultural holdings are generally small and scattered, farming is often subsistence, characterized by simple tools and shifting cultivation. These small farms produce about 80 percent of the total food. Nigeria's diverse climate from the tropical areas of the coast to the arid zone of the north makes it possible to produce virtually all agricultural products that can be grown in the tropical and semitropical areas of the world. In Nigeria, the bulk of food crop production takes place under the traditional system. Holdings are small and the main tools are cutlasses, hoes, axes and knives. These characteristics and other farm practices passed down from one generation to another pose a formidable obstacle in the way of agricultural mechanization.

The contribution of agriculture to the Gross Domestic Product (GDP) was about sixty percent, which is typical for any developing agrarian nation. The decline was as a result of the oil boom. The sector has been hampered by lack of investment in improved farming technology due to financial constraint. Over cultivation of the available fragile soil has worsened the problem of soil degradation.

According to Idachaba et al., (1999), the aftermath of the relegation of agricultural sector has manifested in rising food price, high food import bills, hunger, malnutrition and disease among others.

1.2 Importance of cocoa in Nigerian Economy

The Nigerian economy mainly depended on agricultural sector to provide her needed domestic need and foreign exchange earning before the emergence of oil in the late 1960's. This led to the neglect of agricultural development. Cocoa is still the major agricultural commodity

export in terms of foreign exchange earning. Although, its contribution to the total national export earning during the past two decade dropped (considerably due to the enomity of foreign earning of crude petroleum), yet cocoa remain Nigeria biggest agricultural export (ICCO, 1999).

According to Idowu et al (2007), cash crops like cocoa, groundnut, rubber, palm oil, palm kernel accounted for 69.4% of the total export earning while all non-oil export commodity accounted for 97.3% of the total export before 1970's, but now the reverse is the case.

The importance and contribution of cocoa production and cocoa by-products in Nigeria economy cannot be over emphasized. It performs the following economic roles:

1. Source of income for farmers and revenue for the nation.
2. Provision of employment for thousands of people both at farm level, and at the industrial processing stage.
3. Source of food for man and his livestock.
4. Provision of raw material for agro-based industries.
5. Source of foreign exchange and aggregate export earning for the nation.
6. Its provide high medical and nutritive value for man.
7. Cocoa pod (husk) serves as a source of animal feed and soap making materials (World Bank, 2006)

1.2.1 Uses

According to Wilson (2002) , Cocoa is grown primarily for chocolate production, but the edible pulp is delicious and often consumed in the tropics. Cocoa butter is used medicinally in Brazil for healing bruises, and is used by the cosmetic and pharmaceutical industries. The seeds contain about two percent of the alkanoid theobromine, which is a central nervous system stimulant, similar to caffeine. Theobromine is used as a diuretic and to lower blood pressure,

since it dilates the blood vessels. Dry cocoa seeds (also known as "beans") may contain as much as 12- 18% polyphenols know as cocoa polyphenols or cocoa flavonoids. Most of the polyphenols in cocoa are epicatechin and catechine but other catechris and quercetin are also present. Cocoa flavonoids have potent antioxidant activities and have been shown to scavenge free radicals and inhibit the oxidation LDL. They may also have anti-inflammatory and immunomodulaory activities and may promote cardiovascular and immense health. Cocoa, baking chocolate and milk chocolate all contain polyphenols. (http://www.montosogardens.com/theobroma_cocoa.htm)

Table: 1.1: Nutritional Composition per 100g Cocoa Powder

Carbohydrate	16.5g
Protein	21.5g
Fat	11g
Dietary fiber	34g
Polyphenols	7-18g
Theobromine	2.5g
Caffeine	0.1g
Potassium	2g
Calcium	150mg
Magnesium	550mg
Phosphorous	700mg

Source: http://www.montosogardens.com/theobroma_cacao.htm_2012.

Cocoa is the leading non – oil foreign exchange earner in Nigeria. Cocoa which is popularly called the golden or money tree is one of the major economic cash and industrial crop which has contributed immensely to the socio-economic life of the country. It has generated over 90 percent of the country's foreign exchange earnings during the pre-independence era and

especially before the advent of the oil boom of the early seventies. At the peak of the cocoa economy fortune in Nigeria, the country became the second largest world producer and exporter after Ghana.

About ninety percent of Nigeria cocoa production originated in the south western states. It was the main source of income for millions of farmers in the southern part of Nigeria in Ondo, Oyo, Ogun and Edo states until the oil boom. Cocoa is one of the agricultural produce that has an array of usefulness (cocoa butter, cocoa powder, cocoa paste, cocoa liquor, chocolate etc. It husk is use to feed livestock, soap making industry, shoe polish industry, pharmaceutical parlance use it as its seeds contains Alkaloid theobromine which has a stimulating effect on nervous system (CAN, 2005).

All the cocoa produced in Nigeria in the late 1960s and early 1970s was from 300,000 small holdings covering 1,200.00 acres an average of three-and – a half acres per farmer (1.4 hectares) in the western and Midwest regions which together produced 97.3 percent of all Nigeria's cocoa. In the eastern states, Forty-five percent of these farms were more than 26 years old and 95.0 percent more than 11 years.In spite of the growing importance of oil, Nigeria has remained essentially in agrarian economy with agriculture still accounting for significant shares in gross domestic product and total exports as well as employing the bulk of the labour force. With the coming of oil the main economy sustenance was neglected, the government began to pay less attention to the cocoa sector and production began to fall from peak of about 400,000 tonnes a year in 1970. Nigeria is currently the fourth largest world producer of cocoa with 165,000 metric tones in 1999/2000 (FAO, 1996). Cocoa is grown principally in West African, Central and South America and Asia. In order of annual production size, the eight largest cocoa-

producing countries at present are Cote D Ivore, Ghana, Indonesia, Nigeria, Brazil, Cameroun, Ecuador and Malaysia. These countries represent 90.0 percent of the world population.

1.3 Statement of Problem

Nigeria as a cocoa producing nation was once the second large producer of cocoa in the world and that is not the case presently but can be said to be following Ghana. Prior to this period of oil boom, cocoa has recorded great success, owning to its contribution to the Nigeria economy as major foreign exchange earner, sources of food, employment, raw materials for companies, and it has also contributed immensely to the gross domestic product of Nigeria economy. The fall in cocoa production can first be attributed to advent of crude oil, leading to the neglect of agricultural development. This is then followed by the ageing cocoa farms and farmers, non-adoption of improve technology as a result of low income, and low purchasing power of cocoa farmers to purchase agrochemicals and other inputs that can enhanced the productivity even when cocoa are ageing, lack of information of modern technology to improve cocoa varieties and increase production output. The inability to plant improve seedling or increase seedlings through improve technology, varieties is also another major problem, that would have replace the old cocoa trees (Odeh, 1991). In addition, farmers attention and commitment to cocoa production has reduce drastically and some farmers had abandon the cocoa farming due to problems like water, land scarcity, labour inadequacy and low skill and lack of adoption of improved technologies. The drop in world market of cocoa prices and lack of standard cocoa management board is another factor observed as reasons for the decline in cocoa production. The cocoa trees needs regeneration and total overhauling in some cases due to its decline in total production output as result of poor management practices, pest and diseases, non-

adoption of research findings, lack of credit facilities. If farmers adopt new technology (e.g. Hand Pollination) there is likelihood of improvement.

Government policies which are not preceded by pain-staking collection and analysis of micro-economic data of farmers, which would have thrown light on resources situation on the different cocoa farm and how the economy data could affect the farmers' decision in response to innovations is key.

Hence the problems faced by the farmers and the aftermaths effect it had on the Nigeria economy need urgent attention so as to improve the quantity and quality of cocoa, so as to take back its pride position via use of modern technologies like pollination by hand and encourage farmers to adopt such. This practice will surely secure availability of high numbers of quality improve seedlings of cocoa to replace the ageing once.

Therefore, this study attempted to identify and examine how cocoa farmers' productivity and cocoa production could be improved in Nigeria, and hence this attempt tends to answer the following questions

1) What are the socio-economic characteristics of cocoa farmers in the study area?
2) Are the farmers aware of the uses of improved technologies such as hand pollination?
3) What are the Cocoa production strategies uses presently in the study area?
4) What are the constraints to adoption of hand pollination technologies by the farmers ?
5) What are factors influencing the adoption of available technologies?

1.4 Objectives of Study

The broad objective of the study was to determine the factors affecting adoption of hand pollination techniques by cocoa farmers in Ondo State.

The specific objectives of the study were to:

i. examine the socio-economics characteristics of cocoa farmers in the study area;

ii. ascertain the information sources by which farmers became aware of improved cocoa production technologies.

iii. identify the production strategies use by the cocoa farmers in the study area .

iv. determine the constraints to adoption of hand pollination technologies by the farmers.

v. identify the factors that will enhance the adoption of hand pollination

1.5 Hypotheses of the Study

The following hypotheses were tested based on the research objectives.

Ho_1: There is no significant effect between the socio-economic characteristics of the respondents and their adoption of hand pollination.

Ho_2: There is no significant relationship between the information sources used by respondents and their level of adoption of hand pollination technology.

1.6 Significance of the Study

This study is important as a result of drastic fall in cocoa production of Nigeria in the past two decades in relation to other cocoa producing nation like cote d' Ivoire, Ghana, e. t. c.

There is a need to examine cocoa farmer's production and to help provide certain importance information to Ondo state government and the federal government that have realized the effect of neglect of agriculture and have started encouraging its production.

The information generated by this study will enable the cocoa farmers get assess to good hybrid of cocoa seedlings available as at when due, especially when the farmers themselves are the one that will be multiplying this seedlings via pollination of this seedlings by hand. This will over a long period provide good seedlings to replace the aged cocoa trees. It will also help policies makers and planner to enhance cocoa production base on priority of problem to be

solved in the area of increase the output of cocoa and its contribution to the economy. The study will help government identify, prioritize and solved the problem of production of cocoa seedlings through hand pollination and increase the export earning of Nigeria from cocoa and consequently restore Nigeria back to it leading position among producing countries of the world.

The results of this study will benefit the following categories of people.

i. The cocoa farmers

ii. The various tiers of government

iii. Other researchers

iv. The entire population of Nigeria in term of knowledge and availability of cocoa seedlings as at when needed.

v. The study will also benefit all levels of cocoa marketing structure.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin and Distribution of Cocoa: Theobroma Cacao (Sterculiaceae)

Botanical synonyums (Theobroma sativum), common names in English (cocoa, cacao), Spanish (cacao), Portuguese (cacao), French (cacao, cacaotier). Cocoa is a native to central and western Amazon region. Has been widely distributed throughout the humid tropics, with major commercial production in cote d Ivoire, Ghana, Indonesia, Nigeria, Brazil and Cameroon. (http://www.montosogardens.com/theobroma__cacao.htm , 2012 .

2.2 History of Cocoa Production in Nigeria

In 1892, cocoa was first introduced in Nigeria from Brazil. In 1962, Nigeria was the world leading cocoa producer with twenty percent (20%) of the world total production. Nigeria cocoa production declined before the end of 1970(s), this is due to lack of attention paid to the productive capacity of cocoa as a result of oil boom. But despite of this, cocoa remains the leading major foreign exchange earner in agricultural sector of economy in Nigeria general and in Ondo State in particular. The table below shows that the output of cocoa increased between 1993 to 1998 as a result of the scraping of marketing board,later it started declining, while the recent increases from 2004 was due to cocoa rebirth and hihg level of commitment on the part of the governments. Cocoa has contributed greatly to the economy of Nigeria in terms of foreign exchange earnings, provision of food, income and employment for majority of Nigeria population (Akinbola,2001) .

However , Nigeria's losses in production were not felt in terms of aggregate supply since other countries compensated for them . Nigeria cocoa with its unique aroma is still being very much sought after by users who blend it with other countries cocoa to obtain desired flavour. (CBN,1995)

Table 2.1: Output of major Agricultural Commodities (000 tonnes)

Year	Palm Oil	Cocoa	Coffee	Rubber
1990	730.0	244.0	303.0	147.0
1991	760.0	268.0	320.0	215.0
1992	792.0	292.0	338.0	320.0
1993	825.0	306.0	358.0	225.0
1994	837.0	323.0	3752.0	230.0
1995	687.0	203.0	109.0	255.0
1996	776.0	323.0	178.0	245.0
1997	780.0	325.0	184.0	250.0
1998	792.0	345.0	188.0	255.0
1999	825.0	165.0	194.0	265.0
2000	860.0	170.0	200.0	275.0
2001	894.0	171.0	202.0	278.0
2002	884.0	172.0	205.0	284.0
2003	949.4	185.5	220.0	304.4
2004	187.0	202.6	280.0	328.9
2005	196.4	215.4	245.2	-
2006	209.1	228.0	195.0	-
2007	860.0	176.5	200.0	-
2008	849.0	187.7	195.0	255.0
2009	880.0	205.5	225.5	256.0
2010	798.5	225.4	240.4	257.5
2011	825.3	220.5	245.0	287.0
2012	800.5	250.0	220.5	-

Source: Production year Book Central Bank of Nigeria, Federal Ministry of Agriculture and Rural Development and State Ministry of Agriculture and Natural Resources. 2012

2.3 Characteristics of Cocoa Production in Nigeria

A number of researchers have examined the characteristic of cocoa production in Nigeria. It has been observed that the bulk (more than ninety percent) of output of cocoa in Nigeria comes from small farmers productions efforts. The average size of cocoa holding in Ondo State has been estimated to be between 1.4 to 2.5 hectares (Ajobo 1980) while good cocoa land is becoming increasing difficult to get. Land is generally believed to be an important constraint to increase in cocoa production (Opeke, 1982, Ajobo 1980).

The high cost of inputs like agrochemical, hired labour also serves as disincentive to farmers. That is, credit is needed to lured labour also the purchase of such input as pesticide, spray pumps, improved seedlings, fertilizers and others.

It must be realized that the capital needs of small scale farmer have traditionally come from past saving and loans from friends and relatives. There are some cases however where institutions loans from formal credit have been used, this is becoming increasingly important. Practically all cocoa farmers according to Olayide and Falusi (1975) grow at least two other crops addition to cocoa. Adebayo (1995) beleived that price is very important because it help in the determination of income of farmers, producers and overall allocation of scarce resources .

2.4 Achieving a Revolution in Cocoa Production

Strategies According to Adegeye (2003) a farmer can increase his production by as much as 25% by carrying out necessary cultural practices. These include keeping farms weed free, removal of heavy shade trees, removal of mistletoes, proper pruning before the beginning of rains, application of fertilizers among others. When cocoa trees carry pods, the farmers can maintain to maturity by appropriate chemical application, wrong use of chemicals in the past has resulted in destroying flower cushions in most plants. For instance, spraying copper sulphate

alone without lime may assist in destroying the flower cushions. On most old cocoa trees, the pod formation is now on the branches. This has resulted in high costs of harvesting of cocoa pods. The use of in-appropriating harvesting hooks in the past has also slowed down harvesting. A new portable and that can be assembled to reach a height of soft (10meters) and weight less than 5kilograms is presently introduce to the market (Adebiyi et al., 2006).

Other strategies that can be used to achieve our revolution in cocoa production are increasing the pollinating agents. This calls for increased emphasis on Integrated Pest Management (IPM). Since chemicals used to control harmful insects also kill useful insects. As reduction in the use of chemicals will necessary increase the population? Midgets multiply in wet environments such as stalks of plantain trees and processed cocoa pod husks. Unfortunately, plantain do riot survive long on cocoa farms after proper canopy formation. Furthermore, there is now constant removal of the cocoa pod husks which is being used for making black soap. The solutions to those are simple, first leave pod husks in the farm and keep them moist and protected from d:cops of chemicals. Some cocoa trees have achieved 200-400 pod setting upon there are rotten pod husks located below the trees (http: //www. montosogardens.com).

Also plantain stalks are cut in pieces and are left on heaps all over the cocoa farms. Those plantain stalks decay and provide breeding grounds for midget. At about 7 am these midgets fly out to pollinate flowers. This has been/ tried on some cocoa farms in Ondo State and it is working.

In the same vein, some experiments are on to see the effect of placing beehives in cocoa farms in Ondo State and it is working. It is expected that a colony of bees may substitute for more than 500 pollinators. In collecting their nectars, they will invariably pollinate flowers.

There will be an increase in cocoa production and in honey which might take the chocolate flavour. This will bring more income to the farmers.

Another Strategy is Irrigation: Cocoa trees near streams fruits throughout the year. Cocoa plants, at Ibadan watered throughout the year, carried fruits throughout the year. It is certain that water is the limiting factor in cocoa production. This can be tried even with bucket irrigation. This is possible if there are streams that traverse farms. In some cases, well can be dug. This may make it possible to have continuous production of cocoa (Opeke 1987).

Hand Pollination: It is another strategy used for increasing cocoa production .This is done in Research institutes, seed gardens where hybrid pods are produced and where a plantation is not productive due to incapability or lack of natural pollination.

Procedure: Firstly open flowers pollen with plenty of pollens are collected from any compatible tree with the aid of a pair of forceps. Matured but yet to open flowers are covered with hand made of mosquito nets held down firmly with pins to avoid contamination by pollinating agents in case of hybrid pod production.

Hand pollination can achieve over 100% increase in production within a year, as long as the cocoa trees flower. A tree can be made to carry 50-100 pods at a time. This can be done yearly without affecting the life of the tree as long as adequate fertilizer is applied. All flowers pollinated in a day will nature to ripe pods five months from the day of pollination. It makes it easy to harvest as most of the pods will be on the trucks. It is easy to determine when pods will mature in the dry periods. For instance, cocoa flowers pollinated in August will mature in December/ January when there is abundant sunshine to dry the beans. This will improve the quality of cocoa harvest at this time. (Adegeye, 2003)

2.5 Production Strategies and Methods Use by Cocoa Farmers

Cacao trees are classified into three main groups: criollo , forastero and trinitario. Criollo cacao developed in northern South America and Central America, and have then walled, red or yellow fruits. The seeds are large, round, white or pale purple, not astringent, and produce the highest quality chocolate. Unfortunately, criollo types are low yielding and susceptible to many disease and are rare in cultivation. Forastero cacao is from the Amazon Basin and has a thick walled, smooth, usually yellow fruit. The seeds are flattened and purple in colour. Forastero cacao are very productive and dominate the world cacao productoin. Trinitario cacaos arose in Trinidad as hybrids of criollo and forastero types. They are highly variable, and considered high quality for chocolate production. There are thousands of clones of cocoa in field gene banks in different areas of the world. Some of the largest collections are at the Cocoa Research Institute in Tafo , Ghana (6,000 accessions), the International Cocoa Genebank in Trinidad (1,872 accessions), and CEPLAC in Brazil (1,749 acccessions). The Tropical Agriculture Research Station, in Mayaguez , Puerto Rico, has 372 accessions. (http://www. montosogardens.com).

According to Olaiya, et al (2003) farmers can obtain their planting materials from cocoa Research Institute of Nigeria (CRIN), Agricultural Development Programmes (ADPs), Cocoa Association of Nigeria (CAN) and Cocoa Farmers Association of Nigeria (CFAN). Opeke (1987) observed that old and moribund cocoa trees can be rehabilitated by seeds, air layers, cuttings or grafts, replanting and copping. But due to failure in self-incompatible (Adegeye,2003) encouraged hand pollination.

2.5.1 Propagation by Seeds

Seeds germinate in 5-10 days, but loss viability quickly if they dry out. Seedling should be grown under 50% shade. Cocoa is adequate to humid tropical climate and grow best with light

shade, but will grow well in full sun with adequate soil moisture. (http:// www. montosagardens.com)

2.5.2 Complete Farm Replanting

This is achieved by cutting out all the old cocoa and replanting under newly established shade trees. This permits the use of improve more vigorous, highly tolerant and higher yielding cocoa material, Wood and Lass (1989) noted that complete farm replanting is necessary in the area of mass infection of disease such as swollen shoot virus. He added that seedling of F_3 Amazon material tolerate to the disease can be planted in place of the diseased resistance Amelonado trees.

2.5.3 Phased Farm Replanting

Opeke (1987) explained that this method is used where farm is large. According to him, a given percentage of the acreage is completely replanted annually until the whole area is replaced.

2.5.4 Selective Tree Replanting

Opeke (1987) observed that the method involves the replacement of not less than 35 percent of the old, unthrify cocoa trees from all over the farm. According to him, farmer may want to change the variety of a tree crop, in this case, the rebabilitation is phased over a number of years to enable farmers to earn some income during the period of rehabilitation.

2.5.5 Chupon Regeneration

(Las, 1989) observed that regeneration is achieved by encouraging the re-growing of basal chupons on the main stem. He report that a number of basal chupons are likely to produce from a damaged cocoa trees and two most vigorous chupon should be selected and the rest removed.

2.5.6 Coppicing

This is the complete removal of the main stem of a cocoa tree to encourage the regeneration of the canopy by chupon growth. Odegbaro (1972) showed that regenerated Amelonado trees in their sixth year after coppicing gave a yield of 1,680kg per hectare which is about four times the national average production of 460kg per hectare.

Olaiya, et al (2003) got similar results on F_3, Amazon where coppicing in November performed best in a monthly copping trial. In a monthly copping trial which was started in 1989 at CRIN Ibadan to rehabilitate old and unproductive cocoa trees. 120 F_3 Amazon cocoa trees were coppice at about 20cm from the ground for 3 chupon densities copping were done in each of the 12 month of the year and the control is the 13 treatment. The yield data from 1996-2000 were collected and analyzed for assessment of rehabilitation exercise on the economic returns over the period. The result showed that coppiting in the month of November performed best.

2.5.7 Improved Chupon Regeneration

Opeke (1987) observed that basal chupons growing on old cocoa main stem are latter patch-budded or grafted with material from improved variety for better yielding and disease tolerant, also reported that budded and grafted F_3 Amazon trees cause into bearing faster than the regenerated Ameolonado trees and by the sixth year, yield of F_3 budden and F_3 Amazon way double that of the regenerated Amelonado. Therefore cocoa clones may be self-incompatible, requiring cross pollination to set fruit, this leads to hand pollination.

2.5.8 Hand Pollination

This method is necessary if pollinating insects are absent, and should be done early in the morning using two different trees for cross pollination. Hand pollination can achieve over 100%

increases in production within a year, as long as the cocoa trees flowers. Fruit development takes 120-150 days from pollination to maturity (Adegeye, 2003).

2.6 The Concept of Adoption

Adoption which is the use of technology has been defined by scholars Rogers (1962) , Stanfield (1988) rogers and Shoe Maker (1971) and others. Each emphasized some aspects of adoption such as incidence and intensity of adoption, adoption rate and level of adoption. Norman et al (1997) define rate of adoption as the number of farmers who use a technology as a percentage of the total number of farmers involved in a study i.e (surveyed farmer) while level of adoption is the intensity of adoption which is the number of hectares planted with the improved seeds or the amount of fertilizer applied per hectare or the number of technologies used by a farmer at a time. Feder et al (1985) made the distinction that adoption at the farm level describe the realization of the farmers decision to apply a new technology in the production process of spreading or diffusion of a new technology within a region.

Williams et al (1984) gave a clarification between diffusion process and adoption process. They defined diffusion process as the process by which new ideas spread from one culture or an individual (the source) to another while adoption process is the mental process which an individual passes through from time he or she hears of a new idea and the time he or she finally accept. The concept of adoption is a complex one made up of sequential stages. The predominant role of technology is facilitating major improvement in agricultural productivity. It is therefore important to know how farmers perceive technologies for better understanding of their choice in decision of adoption or not.

Technology is one resource for agricultural production. Ingold (2002) stated that technology differs widely depending on whether the intent is to embrace the totality of human works in all societies and during all epochs. Rogers (1993) reported that technology is a design for instrumental action that reduces uncertainty in the cause and effect relationships comprises of two components: the hardware and the software. The hardware consists of physical tools that embody technology while the software consists of information base for the tool.

Ingold (2002) distinguished between technique and technology. Technique refers to skills as regards the capacity of particular human subject while technology means a corpus of generalized objective, knowledge as long as it is capable of practical application. Technology can reach farmers through technology transfer. Technology transfer refers to the general process of moving information and skills from information or knowledge generators such as research laboratories and universities to clients such as farmers. The outcome of new technology transfer is the farmers' adoption and bringing this into practice and further diffusion to other individuals in the community.

Adoption in agriculture according to FAO, (1994) is the continuous use of new practices such as farm inputs like seeds or chemicals by the farmers after they have become aware of their presence and are convinced that their production could be improved by such new practices. Rogers, (1983) shows the process through which an individual (or other decision making unit) passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject to implement the new idea and to confirmation of this decision. When new ideas are invented, they are diffused and are adopted or rejected.

A community is composed of different groups of people who are homogenous in terms of problems, aspiration and need. The adoption process is essentially a mental decision making process.

2.7 Stages of Adoption

1. Awareness Stage: Learning of the existence of an innovation
2. Interest Stage: Seeking more information about the innovation by making contact with changed agents, mass media, friends etc.
3. Trial Stage: involves application or practice of the innovation on a small scale.
4. Adoption Stage: If the client feels satisfied by his trial he may decide to continue the use of such innovation
5. Evaluation Stage: considers the usefulness, applicability to his situation, cost, constraints etc.

Cruz (1987) stated that, time is an important factor in the process of diffusion. There are number of factors that influence the extent of adoption of technology such as characteristics or attributes of technology, the adopters or clientele which is the object of change, the change agent (extension worker, professional etc) and the social, economic, biological and physical environment which the technology takes place. Socio-psychological trait of farmers is important. The age, education attainment, income, family size, tenure status, credit use, value system and beliefs are positively related to adoption. Also the personal characteristics of extension workers such as credibility, good relationship with farmers, intelligence, emphatic ability, sincerity, resourcefulness, ability to communicate with the farmers, persuasiveness and development orientation. Rogers and Shoemaker (1971) identified important variables that determine the rate of adoption. One of these variables is the perceived characteristics of the

innovation or technology. To be readily accepted or adopted , relative advantage, compatibility, complexity, trial ability and observability. Some technologies are adopted more rapidly than others because the farmers perceive them to have different characteristics.

Traditionally, the adoption process consists of five sequential stages of Awareness-Interset-Evaluation-Trial-Adoption-Rejection may interrupt the process at any stage and adoption process ends there.

Adoption had been categorized into five groups in any community as fellows:

[1] Innovation [2.5%]

[2] Early adopters [13.5%]

[3] Early Majority [34%]

[4] Late Majority [34%]

[5] The Laggards [16%]

Studies by many researchers (Akinola 1986, Osuntogun et al 1986, Arene 1994, Agbamu 1995, Ogunfiditimi 1981) e. t. c. have confirmed some factors which influence the adoption of a new technology. These are classified as follows:

i. The characteristic of farmers (age, level of education e. t. c)
ii. The characteristics of farm (location, farm size e. t. c.)
iii. The nature of technology (relative advantage, compatibility, complexity e. t. c.)
iv. Characteristics of the change agent agent (communication ability, technique used, human relation e. t. c.)
v. The farming objective (either commercial or subsistence).

According to kaliba et al., (1998) some of the improved technologies include:

1 Improved seed varieties.

2 Land clearing by machines.

3 Time of planting.

4 Planting method

5 Planting space.

6 Time of weeding.

7 Sole cropping.

8 Fertilizer application.

9 Use of herbicide \ weedicide.

10 Harvesting method.

11 Storage.

12 Improved processing method.

13 Method of pest control.

14 Improved marketing facilities

2.8 Importance of Pollination

Pollination is the transfer of pollin grains from the anther of one flower to the stigma of another flower. This process is usually by natural occurrence, however for the purpose of commercial need and to meet up with the quality and quantity needed human pollination is use by hand. Hand pollination is seen as the process of bringing an unproductive cocoa plot back into economic productivity. A plot is said to be unproductive if the yield had fallen to about 25% of what is obtainable at peak (5 – 10 years after establishment). Pollination is recommended when cocoa trees need to be replaced and quality cocoa seedlings are not available. The maintenance

practices that are expected in cocoa plantation include soil/water management practices, control of weeds, pest and diseases, removal of black pods and mistletoes, sanitation or structural pruning, application of fertilizer and timely harvesting. Most cocoa farms in Nigeria start to decline in productivity from the age of between 17 and 27 years and in some cases earlier when this decline continues until the yield brings no economic returns. Available data shows that most of the cocoa farms that made Ondo State to attain the leadership position in cocoa production have either become completely destroyed due to bush burning and urbanization (construction of airports, schools, hospitals, roads etc) or at present producing far below the threshold of economic returns due to old age (Adegeye, 2003).

Hence, for us to achieve those glories of the past, we have to under study the causes and identified the factors that have rendered many cocoa farms uneconomical

1. **Age of Farmers:** The farmer grows older at the same time as the cocoa trees; there is silence to invest in the renewal. In addition, there is reduced energy, initiatives and money at the time when the trees require attention. The farmer needs to train his children especially the educated and out of work young school leavers.
2. **Land Tenure Problem:** One silent but prevalent problem of cocoa is limitation of productive (fertile) land. Willing and able bodied cocoa farmers have no access to productive land due to land ownership and tenured problems.

Adegeye (2003) reported that farmers could hardly expand the area of cocoa as most useful lands for cocoa had been used and mainly forest reserve and marginal land are or can be available for few planting. Land tenure system in Nigeria according to Opeke, (1981) which is based on family ownership allows for cropping on fragmented pieces of land scattered all over. The system does not permit large scale holdings and economic production.

3. **Socio-Economic Factors:** It is expected that earnings from cocoa will pay for all operations on the farm and leave enough surplus either for expansion or investment in other areas. Regrettably, however, cocoa prices have not enabled the realization of this expectation (Anon, 1995). Identified farmers constraints include:

i. low producer price
ii. income and expenditure pattern of farm household
iii. high price of inputs availability on a sustainable basis
iv. Farmer priorities, preferences and capacity to implement research recommendations.
v. Pattern of land holdings, tenurial arrangements, inheritance and fragmentation of farmers
vi. Lack of workable credit or loan facilities
vii. Poor social circumstances of farmers

These problems have caused some farmers to neglect their farms and to shift to other crops (Osei, 1993). The poor educational facilities, health communication and infrastructural facilities have also resulted in the drift of the youth from the rural areas to the urban areas. This has greatly affected the availability of farm labour, leading to high cost of labour and consequently the deterioration of farms.

4. **Pest and Diseases:** Yields of cocoa in Nigeria are lower than those recorded in other countries where they are cultivated. One of the major reasons for the poor yield is diseases and pest which have been estimated to cause 20 – 30% (African Journal, 2005). Among the economically important pest of cocoa are the capsids also known as mirods and the cocoa pod borer. According to ICC (2000) the pest capsid bug currently destroys 20 – 25% of Nigeria annual cocoa crop. The black pod is most prevalent in the dry season. High crop yield can be achieved of plants are protected from diseases and pest.

This will make plants to grow well, take up nutrients, compete with weeds and yield to the limit of their environment (Cook, 1986). Small scale farmers therefore require crop protection measures that are cheap (so that farmers can afford them), simple (so that they can be applied under particular circumstances), cost effective (so that they can enable farmers to make profits and prosper) and sustainable (so that the production is also sustained).

5. **High Cost of Agrochemicals and Other Inputs:** The cost of agrochemicals and other inputs are still very high and they are not readily available to the cocoa farmers at the right time. Most of these farmers live in the rural areas where these chemical cannot be purchased. As a result of this, they have to travel down to the urban areas where these chemicals can be purchased. But due to poor road network and transport facilities, there is usually a delay in obtaining them. This in turn affects the cocoa trees as a result of the decay (Idachaba,2000).
6. **Weather Problem:** This is an age long problem of cocoa. Weather problem is significant in terms of prolonged dry season which causes death of both newly transplanted seedlings and old trees alike. It has also been established as a facilitator of bush fire which often destroys large plantations of matured cocoa. Irrigation is the only solution to this problem; hence farmers/farmers groups should endeavour to provide their farms with wells with which they can apply water especially to their newly transplanted cocoa seedlings (Idachaba,2000).
7. **Poor Fermentation and Drying of Cocoa Beans:** A prominent problem of Nigeria cocoa is low quality. This can be attributable mainly to poor fermentation and drying of the beans. Instead of the recommended fermentation period of 5 – 6 days, most farmers

choose to ferment cocoa beans for only 2 – 3 days. The scenario is further heightened by shylock produced buyers who would buy poorly fermented cocoa and take them out for sun drying worst still; the sun drying in most cases would also be poorly done before bagging of the beans (Idachaba,2000).

In view of the above, the problem of poor fermentation and sun drying of cocoa beans could be eradicated by sensitization and training of farmers on ideal cocoa fermentation and drying techniques.

Devices of mechanical fermentation machine and artificial drying equipment,

8. **Poor Management Practices:** Management practices which are poorly done include weeding, pruning, spraying appropriate fertilizer application, timely harvesting etc. Weeds compete with crops for both water and nutrients and sometimes habour pathogens. In a newly established cocoa farm according to Adenikinju (1998) weed control constitutes the greatest problem during the first 3 – 5 years of establishment when cocoa canopy is not yet closed. Weed incidence could also be a problem in mature plantation with missing stands, wide gaps in the canopy.Most farmers give their farms to hired labourers on contract for share of the produce. Such farmers are old, illiterate and absentees with no proper farm records. A lot of money is therefore lost to these hired labourers who sell most of the produce behind the farmers and declare little returns which is further shared between the owner and the contract labourer. Farmers should ensure regular visit and ensure appropriate farm records i.e record of inventory, production records and records of expenditures and income. This will ensure that the farmers are not cheated and can evaluate the performance of the farm at any given period of time (Idachaba,2000).

9. **Unavailability of Finance/Credit:** A major constraint for these cocoa farmers is their inability to obtain loans from banks and financial institutions to boost their yield. Financial assistance is also not coming from the government so farmers are left with little or no finance to help improve their cocoa farms (Idachaba,2000). .

10. **Poor Pricing and Market Outlets:** It is no gain saying that most of the aged Nigeria cocoa farmers have abandoned their farms because of poor returns at the end of the year: Unlike most other agricultural crops, cocoa has some low maintained an average price of N170/kg in the last two decades whereas cost of agrochemicals and other inputs are on the increase. To make matters worse, there are limited market outlets for cocoa which is probably a function of the next problem to be discussed (Idachaba,2000).

11. **Absence of cocoa Consumption/Utilization of Cocoa:** As mentioned above, the problem of low pricing and poor market outlet for Nigeria cocoa has largely been attributed to absence of local consumption and utilization of cocoa in Nigeria. It is not worthy that whereas the price of cocoa beans has declined from about $2,386in 1986 to a mere $1,300 in 2006, the price of chocolate bar conversely moved from about 5 pence to 50 pence per bar. In essence, the price of cocoa by-products in Europe and other cocoa consuming nations are on the increase while that of cocoa beans has been poorly priced from Africa which accounts for over 70% of world cocoa production (Idachaba,2000).

12. **Low Application of Research Findings:** Fund and manpower are traceable to persistent problem of low application of research findings. For instance in the year 2005, cocoa research institute of Nigeria (CRIN) volunteered that it has a new variety of cocoa which matures in 18 months. As at today, the variety is yet to be produced sufficiently for farmers use due to poor funding and limited man power at CRIN. The onus is on the

federal government to fund research institutions adequately to enable them carryout and disseminate research findings for ultimate use as appropriate (Idachaba, 2000).

Other factors affecting resuscitation technologies in Ondo State include:

i. Depletion of soil (fertility)nutrients
ii. Transportation problem
iii. Low yielding varieties of cocoa trees
iv. High cost of labour
v. Natural hazard

2.9 Economics of Cocoa Production

Studies on the cost and returns from cocoa production in Nigeria have been carried out by many researchers (Olayide and Falusi, 1975, Adesimi and Ladipo, 1975, Ajobo, 1980). The main element of the cost structure of cocoa production are family and hired labour input are used for land clearing, planting, weeding, mulching, pruning, shading fertilizer, disease and pests control, processing, seeding nursery materials, shade materials, fertilizers, insecticides, fungicides, tools and equipment and transportation equipment.

According to Olayide and Falusi (1975), costs and returns data were presented for two types of farm organization. These farm organizations are the traditional form in which local tool yielding, old amelondo variety of cocoa are inputs used by the small scale farmers. While the form is the modem smallholding in which full advantage of the latest achievement of cocoa research is used, that is, modern technology is adopted including improved inputs like Amzon and Hybrid cocoa varieties, fertilizer and effective plant protection measure. Thus, revenue is derived solely from the sale of dried beans. According to Olayide and Falusi (1975) revenue will only come from sale of cocoa beans. This is quiet a restructure assumption especially when it is

realized that inter planting of cocoa with other crops is a common feature of the traditional farmers. The gross returns from these crops are expected to increase with value and number of inter planted crops.

More so, the small-scale farmers have been proved to be efficient allocations of productive resources (Olayemi, 1973). The study carried out by Ajobo (1980) dealt with costs and returns obtained from the cocoa Research Institute of Nigeria (CRIN). Unlike the study carried out by Olayide and Falusi (1975), Ajobo (1980) considered revenue from both cocoa beans and plantain growing primarily for sale. Cost data were generated from that incurred from the establishment and maintenance of the plantain and cocoa tree over a period of five-years.

Through this study Ajobo, (1980) recognized the inter croppmg characteristics of small-scale fanners, it enjoined the facilities and improved varieties of a research institution which may not be opened to the farmers. Apart from this, it lacked the socio-cultural and economic condition under which small scale farmers operate. That is, problem. Such as land tenure, local old cocoa trees producing well above economic life, untimely supply of high cost of inputs were ignored. Ajobo (1980) then suggested that long term credit at low cost interest rate maximum of three percent (30%) would be needed for the small-scale farmers for optimum production. This is to serve as incentive to farmers in cocoa production. In the context of the present day bank rate of nineteen to twenty one percent (19% to 21%), this may not be feasible.

2.10 Cocoa Farmers in Ondo State

Ondo State has been the leading cocoa producing state in Nigeria before the establishment of the National Cocoa Development Committee (NCDC) in 1999. The state is still the number one Cocoa producer state amidst stiff competition from other states especially Cross River State, with over 60% of the annual cocoa production in Nigeria from Ondo State.

Cocoa provides employment and income to farmers as well as revenue to the state government for her development programme.

Table 2.2 :Ondo State Cocoa Figures 1996 – 2012 in Metric Tonnes

Year	Tonnage
1996	43,900
1997	41,182
1998	27,895
1999	31,155
2000	24,048
2001	45,875
2002	54,219
2003	64,906
2004	69,822
2005	57,076
2006	61,835.5
2007	45,023.5
2008	60,039
2009	58,055
2010	65,000
2011	45099
2012	-

Source: Ondo State Agricultural Development Project (2011).

Majority of these cocoa farmers are poor peasants who earn minimal wages for their yield. Cocoa business in Nigeria is fragile because the farmers in the business are incapacitated. The farmers are incapacitated because of

1. Poor education inhibiting the dissemination to an adoption of efficient production technology by farmers.
2. Increase cost of input and problem of infrastructure like inefficient transport system.
3. Disease infestation on farmers (malaria) these reduces his/her productive capability
4. Cocoa farmers are incapacitated by low prices of cocoa beans occasioned by fluctuation in international price of cocoa etc. (Ojo, 2005).

2.11 Theoretical and Conceptual Framework

In the past, different models in the area of adoption concept have been worked upon as models for generating acceptable technology or new innovation. Different approaches have been recommended and tried. However, no particular model or system is considered most appropriate for variety of situations. This is because the value of these different models or approaches addresses specific problems. Each approach tends to reflect a particular set of problems, objectives, resources and client groups to be served.

Some of the theoretical models that have been developed include the following:

2.11.1 Farmer-Back-To-Farmer Model

The steps involved in the F-B-T-F model included;

1. **Defining the Problem:** Problems are defined from the perspectives of the various disciplines involved in the research such as the biologist, pathologist, and social scientists e.t.c.
2. **Seeking for Solution:** Having defined the problems through the instrumentality of the signs and symptoms of the problem at hand, each authority from his point of view designs solutions to the problem.
3. **Testing and Adaptation of Technology:** The social scientists, with the cooperation of the farmers test the recommended solutions by adapting them to the farmers' situation.
4. **Farmers Evaluation:** The result of the testing and adaptation gives the farmers the opportunities to observe the effect of the adopted solutions. If positive change is observed vis-à-vis the identified problems the farmers adopt the recommended solution for practice.

The Farmers-Back-To-Farmer Model is a viable alternative to the traditional agricultural research and extension approach. The philosophy of the F-B-T- F model is that agricultural research and development must begin with the farmer that is, the farmer's perception of the problem must be obtained, also his evaluation of the ;solution should be accepted. [2]Based on the philosophy earlier stated, this model has some goals that are achieved through certain activities. These are:

i. Diagnosis

ii. Interdisciplinary approach (Term Research)

iii. Interdisciplinary testing and adaptation

iv. Farmers evaluation (Rhoads and Booths, 1992)

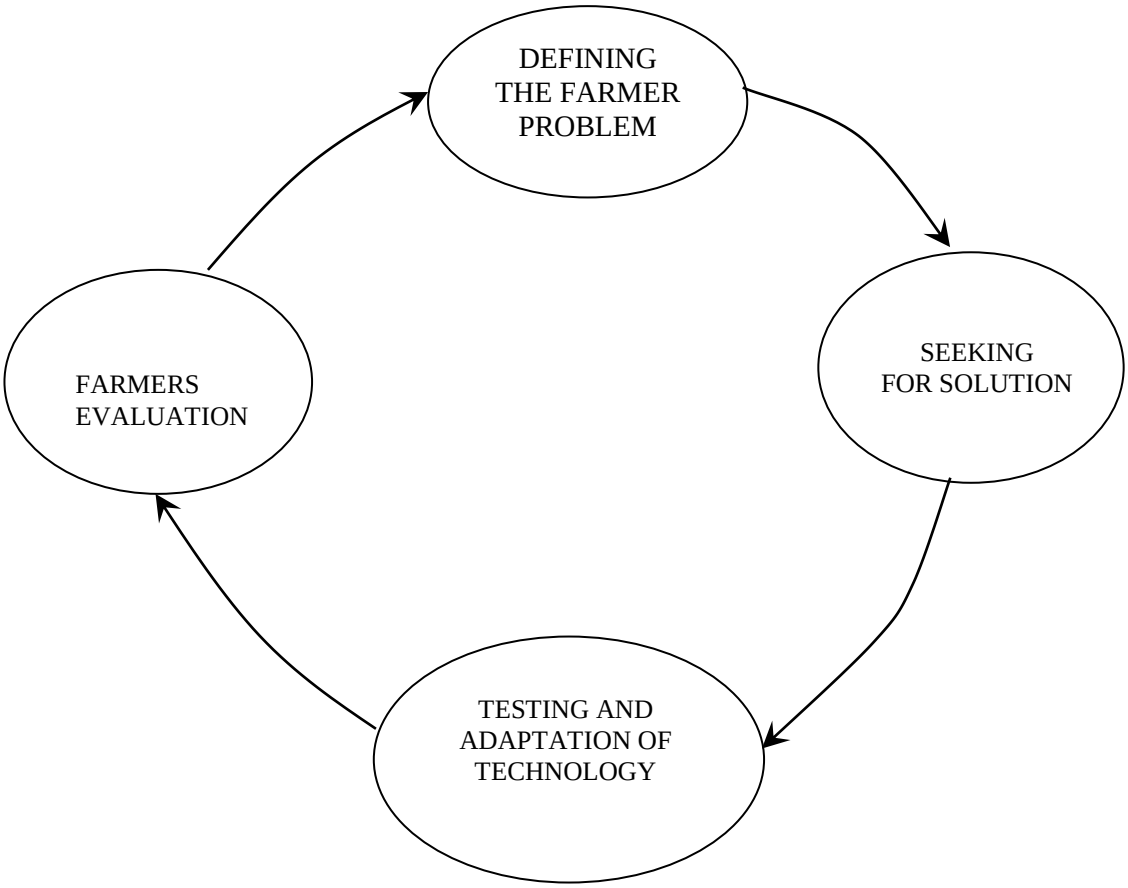

Fig. 2.1: Farmer-Back-To-Farmer Model (Rhoads and Books, 1992).

2.11.2 Simple Conception of a Technology Development, Transfer and Utilization System

Technology Development, Transfer and Utilization System as framed by Havelock (1976) makes up of three section mainly. Technology Development (Agricultural Research), Agricultural Extension and Technology Utilization (Farmers). Based upon the package, it is assumed that technology on increased production is developed through research. Such technologies may include improved seeds, fertilizers, herbicides, farm machines and the like which the researchers intend to adapt to the farmers' situation. The activities of extension depend mainly on research findings. Raeburn (1984) had earlier expressed that, the efficiency of extension work depends heavily on relevant research.

Extension as a component of the model is a route by which information on farmers' problems reaches research and also by which that on solutions to the problems get back to the farmers. The efficacy of the interactive linkage between research and farmers is consequent of extension activities. Farmers constitute the end users of the model. They are the utilizers of technology. This section of the package is where the technology is being evaluated and feed-back sent through extension to research.

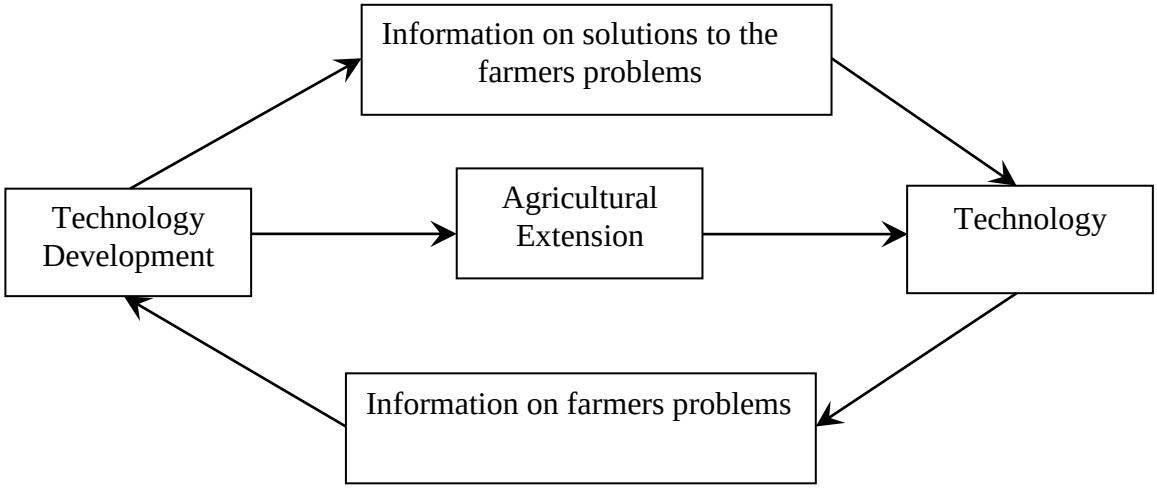

Fig. 2.2: Simple Conception of Technology Development, Transfer and Utilization System (Havelock, 1976)

2.11.3: Research Development and Diffusion (RD and D)

The model deposits of population which can be reached effectively and influenced through dissemination of information. In this model emphasis is not given to the end users. However, the dissemination efforts are preceded by an extensive and complex process of research development. The research development consists of basic research, applied research, development production and packaging. In a sense, the model says that "if the knowledge is there, a user will be found for it".

The assumption of the model

a) It sees development and utilization as a rational process
b) There has to be planning on a massive scale
c) There is division of labour and separation of roles and functions
d) There is a defined audience but the audience is assumed to be passive
e) It assumes that one has his initial investment for maximum profit

In summary the RDD model looks at the process of change at the researchers' point of view. It start with formulation of problems on the basis that identification is taken by the researcher and not the receiver.

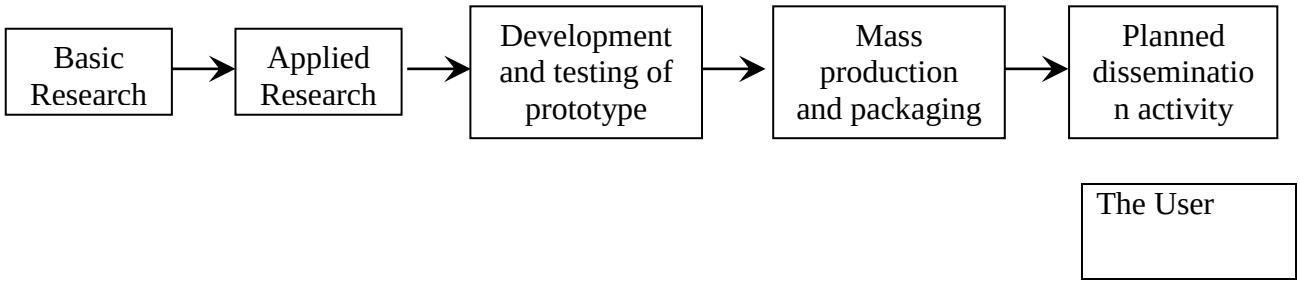

Fig. 2.3: Research Development and Diffusion (RD and D), McQuail D and S. Windhal (1981)

2.12 Conceptual Framework of the Factors Affecting the Adoption of Hand Pollination Technique by Cocoa Farmers in the Study Area

Figure 2.4 shows the effects of input or independent variables of socio economic factors and other factors on the adoption of hand pollination technique. Socio-economic factors which include age, gender, marital status, religion, education, household size, occupation, experience, annual income, farm ownership, farm size, sources of labour, source of capital e.t.c. other factors also include socio-psychological traits of farmer (attitude, perception, knowledge, awareness, interest). These independent or input variables have influence on adoption or non-adoption of technology by cocoa farmers. These variable influence farmers' predisposition to act, perceive think and feel towards a phenomenon which are dynamics of adoption research.

Other factors influencing the adoption of hand pollination at throughput or intervening stage include government policy, extension activities, knowledge transfer byNGO's and consultants, research institutes and sources of information that will play key roles in the dissemination of the hand pollination technique, the sources of information that will create

awareness about the technology, the diffusion of the innovation, trail of the innovation and evaluation of the innovation.

Rehabilitation strategies on the other hand have to do with the process of bringing unproductive cocoa trees to economic productivity. The rehabilitation strategies include planting of improved varieties, pruning of old branches, weed control, appropriate fertilizer application, integrate pest management, spraying copper suplphate with lime, placing beehives in cocoa farm, bucket irrigation, complete farm replanting, phase farm replanting, hand pollination techniques e.t.c.

The diagram below shows that farmers who adopted these rehabilitation strategies and hand pollination techniques had increase in yield, improved income and standard of living, provision of employment, increase to foreign exchange and increase in provision to cocoa agro-based industries. On the other hand farmers who did not adopt these technologies had decrease in yield, low income and standard of living, affected by natural hazard (shortage of natural pollinating insects) and lack of workable capital.

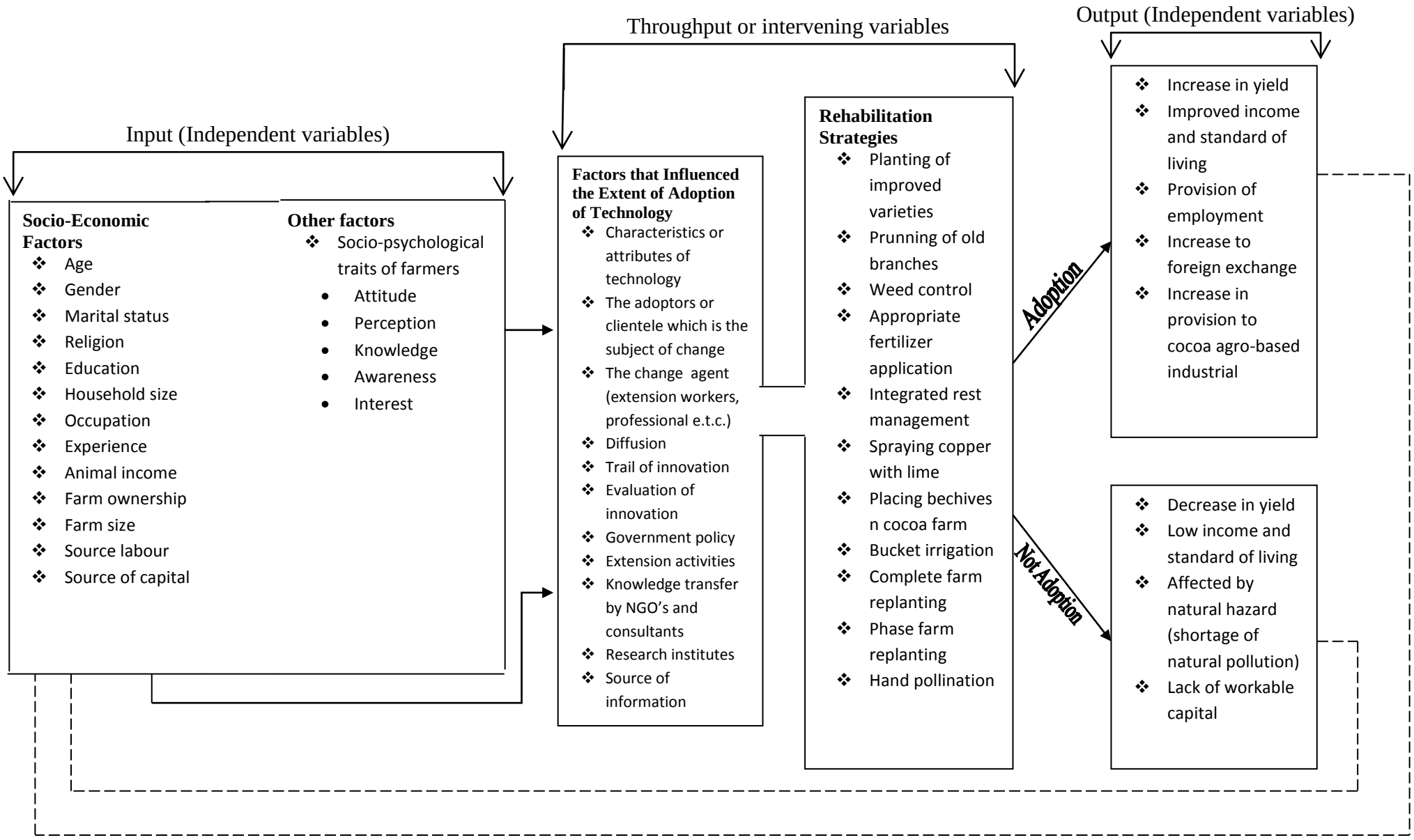

Figure 2.4: Conceptual Framework for the Study

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 The Study Area

The study was carried out in Ondo State, Nigeria. This state is one of the 36 states of Nigeria and was carved out of the old western state on 3rd February 1976, out of which Ekiti State was carved out in 1996. This state is one of the six Yoruba speaking states in the South-West of Nigeria and it is bounded in the West by Osun and Ogun States, in the North by Ekiti and Kogi States. Ondo State also shares boundary with Edo and Delta States in the East and the South by Atlantic Ocean. Ondo State has an area of 14,769km^2. The state is made up of 18 local government areas with total population of 3.4 million inhabitants (Census, 2006).

With respect to the climate of the state, it is tropical with two distint seasons of rainy and dry seasons. The rainy season occurs between April and October, while the dry season begins in November and last till April, although in recent times, minor alteration are noticeable in rainfall regions due to global climate change. The state is blessed with 12 dorminal sunshine hours and a moderate all year round temperature varies from 25^{o}C. Annual rainfall varies from 2000mm in the southern extremes. The favourable geographical location and climate condition make the state a veritable agricultural zone for the cultivation of diverse crops as well as propagating and utilization of forest resources. Ondo state can produce virtually all major crops grown in Nigeria. Food crops grown include maize, yam, cassava, plantain, rice, pineapple, vegetables such as tomatoes and pepper, cocoyam, as well as tree crops like cocoa, coffee, kolanut, oil palm,

citrus, cashew etc. Forest trees include teak, gmelina, mahogary, Iroko, Afara and Obeche among others.

3.2 Sampling Procedure and Sample Size

A multi-stage sampling technique was used. The target population for this study was cocoa farmers that have used hand pollination techniques. In the first stage, five local government areas (LGAs) which are prominent in cocoa production based on cocoa output figures were purposively selected for this study. The local government areas were Idanre, Ondo East, Ile-Oluji/Okeigbo, Odigbo and Ifedore.

In the second stage stratified sampling techniques was used to select two LGAs with highest cocoa production capacity and of which hand pollination technique (HPT) had been officially intoduced and practiced, these were Idanre and Ile oluji/Okeigbo LGAs.

The third stage involved purposive selection of five (5) cocoa growing communities that have used hand pollination techniques in each of the two local governments; this makes total of (10) communities that were used for the study. At the fourth stage, in each community ten cocoa farmers were randomly selected and interviewed. A total of one hundred cocoa farmers were selected for the study.

3.3 Data and Instrument of Data Collection

This study used both primary and secondary data. The primary data was from a pre-test and validated questionnaire admnistered on the respondents. The main instrument for collecting the primary data was structured questionnaire that were administered during schedule meetings with the farmers.

The secondary data was obtained from published articles, journals and other relevant texts, also sources like internet and government institution such as A.D.P Ondo state was utilized.

3.4 Measurement of Variables

There are two categories of variable that were measured in this study. They were dependent and independent variables.

Dependent Variable

The dependent variable of the study was the level of adoption of land pollination technique.

Independent Variables

The independent variables of the study were the socio-economic characteristics of the respondents such as age, gender, marital status, education background, religion, years of experience, annual income, occupation, farm ownership, farm size, farmer' output, sources of capital, sources of labour.

Socio-economic characteristics were measured thus:

Age: This variable was measured by asking respondent to state their age in years and coded (a) < 20 (b) 21-30 (c) 31-40 (d) 41-50 (e) 51-60 (f) 61-70 (g) 70 and above.

Gender: It was measured by nominal level and labeled: Male-1, Female-2.

Marital Status: It was measured at nominal level and labeled; Married-1, single-2, widowed-3.

Education: Education level of the respondents was measured in year formal education and non-formal education. Attempted primary school-1, completed primary school-2,

attempted secondary school-3, completed secondary school-4, OND/NCE-5, BSc/MSc-6, and non formal education-7.

Religion: Respondent were asked based on the religious and measured thus; Christian-1, Muslim-2, traditional-3, others-4.

Years of Experience: This was computed based on the number of years respondents have been involved in cocoa production, used interval of 1-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, and over 20 years.

Annual Income: This was completed by ranging structured interval amount and measured in Naira. 200,000-599,000; 600,000-999,000; Im-1.999 and above.

Occupation: Respondents were asked to indicate the job they were engaged in and each job was coded. Cocoa farming-1, Artisan work-2, Civil servant-3, others-4

Farm Ownership: Respondents were asked to indicate how they got their farms, and that was measured thus:

Purchased-1, Rented-2, Inherited-3, family owned-4.

Farm Size: Respondents were asked to indicate the area of cocoa farmland under cultivation. It was measured in Hectare (Ha).

Farmer ‘s Output: This was measured at nominal level and based on Tonne. 1 Tonne=1, 2 Tonnes=2, 3 Tonnes=3, 4 Tonnes=4, > 5 Tonnes=5.

Source of Capital: Respondents were asked to indicate their sources of capital and was measured thus; Personal savings=1, loan from cocoa buyers=2, cooperative=3, commercial bank=4, Esusu/Ajo=5, Friends/Relatives=6.

Sources of Labour: Respondents were asked to indicate their sources of labour and measured thus; Family labour=1 Hired labour=2, family and Hired labour=3.

Measurement of other objectives. The objectives were measured thus;

1) To ascertain the information sources by which farmers became aware of improved cocoa production technique. Frequency and percentage were used to measure the various information sources through the respondents; Extension Agents, Radio programmes, Agric bulletins and Fellow farmers.
2) To identify the production strategies used by the cocoa farmers in the study area. This was measured based on mentioned cocoa rehabilitation practices. Four points likert scale was used; Always, Occasionally, Rarely, Never.

	Statements	**Always**	**Occasionally**	**Rarely**	**Never**	**Mean**
A	Integrated pest management					
B	Spraying copper sulphate with lime to avoid destruction of flower cushions					
C	Use decayed plantain stalks that influence breeding grounds for midget fly assists in pollination.					

3) To determine the constraints faced cocoa farmers in the study area. Frequency and percentage were used to measure the proportions of various constraints faced against cocoa farmer.

S/N	Constraints	Yes Frequency %	No Frequency %
1	Low extension contact		
2	Lack of improved cocoa varieties		
3	Credit facilities problems associated with request for collateral security		
4	Pests and diseases problems….		

4) To identify the factors that will enhance the adoption of hand pollination. This was measured based on the mentioned factors (statements). And measured at 4-points likert scale; Always, Occasionally, Rarely, Never.

S/N	Statements	Always Freq. %	Occasionally Freq. %	Rarely Freq. %	Never Freq. %	Mean
A	Age of cocoa					
B	Pests and diseases control					
C	Exposure of reliable source of information and knowledge…					

3.5 Method of Data Analysis

The study made use of descriptive statistics such as frequency distribution, percentage and means to analyse the variables of the farmers such as age distribution, marital status, sex .e.t.c. In addition , inferential statistics such as multiple regression analysis, logit regression and chi-square were also used to analyze the data collected from the field

3.5.1 Analytical Techniques

Multiple regression analysis;

This is used when the researcher is not only interested in the relationship between two or more variables but in the cause and effect relationships (Olayemi et al., 1981). The study was interested in the factors affecting the adoption of hand pollination of cocoa in Ondo State, where socio economic characteristics is one of the factors. Implicitly, multiple regressions are stated as follow.

Y= f (x1, x2, x3…….xn)

This could be stated explicitly as follows;

Y = b0 + b1x1 + b2x2 + b3x3+…….bnxn+ e

Where,

Y= dependent variable or explained variable.

B0= constant term

B1-bn= regression co-efficients

X1-xn = independent or explanatory variables

e= error term or disturbance terms.

Multiple regression analysis of the socio-economics characteristics that influenced the adoption of hand pollination of cocoa to get improve seedlings using both the step wise and forced entry regression method.

The model could be explicitly stated as follows

$Y= b0 + b1x1+ b2x2 + b3x3 +b4x4 + b5x5 +b6x6 + e$

Where,

Y = level of adoption of hand pollination technology

B0= constant term

B1-b6= regression coefficients

X1 = Age of farmers (in years)

X2 = Income of farmers (in Naira)

X3 = Level of education (in years)

X4 = Years of experience .

X5 = Cocoa farm size .

X6 = Household size .

e = error term.

The dependent variable is level of adoption of hand pollination while the independent variables are the farmers' socio-economic characteristics. The set hypothesis was tested at 0.05 level of significant.

Binary logistic regression analysis

Binomial (binary) logistic regression is a form of regression, which is used when the dependent variable is a dichotomy and the independent variables are of any type.

Logistic regression analysis is used where the research is not only interested in the relationship between two or more variables but in the cause and effect of relationship by using dichotomous means. In this study, we are interested in the factors affecting the adoption of hand pollination of cocoa by farmers in the study areas, where socio-economic characteristics are some of the factors.

This tool was used to analyze hypothesis Ho1.

The binary logistic regression model would be explicitly stated at follows:

Logit (p) = b0 + b1 x1 + b2×b2 + b3×b3 + b4×b4 + b5×b5 + b6×b6 + b7x7 + e

Where,

P = probability of adoption of hand pollination techniques

b0 = constant terms

b1 - b7 = logistic regression co-efficient

×1 = Age of the farmers (years)

X2 = Annual income

X3 = Sources of capital

X4 = Level of education chamber of years spend in school

X5 = Age of the farm

X6 = Farmers'output

X7 = Types of crop planted

The logit transformation is defined as the log odds.

Odd $\frac{p}{1-p} = \frac{probability\ of\ adoption}{probpability\ of\ nonadoption}$

Logit (p)= In $\frac{p}{1-p}$

Where: In = natural logarithm

Chi-Square

The null hypothesis HO2 was analyzed using chi-square. This used when data can be classified into natural exclusion classes or categories. The objective is to test if observed frequencies in each category are significantly different from those which can be expected if some hypothesis were true. If the observed frequency of the ith outcome is denoted by Oi. Chi-square analysis was used to test if there is no significant relationship between sources of information on hand pollination technique by cocoa farmers and their adoption.

Then we want to know if Oi…....OK are campatible with $e_i \ldots e_k$

Chi-square statistic is estimated using the following equation

$$X^2 = \sum_{i=1}^{K} \frac{(o_i - e_I)^2}{e_I}$$

Where,

X2= chi-square

Oi= observed frequency

ei= expected frequency

K = total number of cells (category).

CHAPTER FOUR

RESULT AND DISCUSION

4.1 Socio- Economic Characteristics of Respondents

All the respondents are cocoa farmers and of different categories.

4.1.1 Age of the Respondents

Table 4.1.1 revealed the age distribution of the respondents. The modal class of the age group was between 51-60 years which is 30.0 percent, while 29.0 percent were 70 years and above, 16 percent were between 31-40 years, 11 percent were between 21-30 years, less than 20 years were two percent. Age is an essential factor in farmers' productivity. The quantity of work a farmer can do has a direct relationship with his or her age. Ajibefun et al (2002) revealed that the technical inefficiency of farmers increases with age. Table 4.1.1 also shows that higher percentage of the active age are still involve in the cocoa farming production which are ages between 31- 60 with aggregate of 58.0 percent. However, age distribution in a study such as household socio-economic characteristics and adoption of innovation is germane because of they believe that farmers in old age grade are more resistant to innovation on agricultural improvement than the younger ones (Alfred 2002, and Okunlola et al 2007).

Table 4.1.1 Distribution of Respondents by Age

Age group (in yrs)	Frequency	Percentage.
< 20	2	2.0
21-30	11	11.0
31-40	16	16.0
41-50	12	12.0
51-60	30	30.0
70 and above	29	29.0
Total	100	100.0
mean; 4.5		

Source: Field Survey, 2010.

4.1.2 Gender of the Respondents

Gender is also important factor in determining the choice of an agricultural enterprise to embark upon, for instance women are found more in marketing and processing while men are more into cultivation which involve rigor of farming (Ajayi and Okunlola, 2000). Tables 4.1.2 shows that 90.0 percent of the respondents were male while 10.0 percent were female; this shows that a large percentage of cocoa farmers in the study area were men and this could be attributed to many factors such as issue of land inheritance for a permanent crop and the vigor of cultivation.

Table 4.1.2 Distribution of Respondents by Sex

Sex	**Frequency**	**Percentage**
MALE	90	**90.0**
FEMALE	10	10.0
TOTAL	**100**	**100.0**
mean 1.15		

Source: Field Survey, 2010.

4.1.3 Marital Status

Farming is an activity that could be enhanced by marital status in view of family labour and decisions making, hence the distribution of the Table 4.1.3 below shows that 75.0 percent of the respondent were married while 13.0 percent were single, seven percent were widow and five percent widower. The implication of these is that married farmers with large family get work done easily especially during peak period, in addition they pay less on labour for farm work. Most of the married farmers also get money from merchants on the agreement that they will use it to buy cocoa which they seldomly do with single farmers. Most of the widows stated they inherit these farms from their late husband.

Table 4.1.3 Distribution of Respondents by Marital Status

Marital Status	**Frequency**	**Percentage**
Married	75	**75.0**
Single	13	13.0
Widow	7	7.0
Widower	5	5.0
Total	**100**	**100.0**
Mean ; 2.014		

Sources: Field Survey, 2010.

4.1.4 Education Background

From the Table4.1.4 87.0 percent of the respondents had formal education. Eleven percent had attempted pry school, 13 percent completed primary school, five percent attempted secondary school, and 25.0 percent completed secondary school while 24.0 percent had OND/NCE and nine percent had BSc/MSc. The Table also revealed that 13 percent of the respondents had no formal education. The implication of this is that the farmers could be receptive to new innovations. This is because, education is known to have positive influence on farmers' productivity as there is positive correlation between education and adoption of technologies. Okunlola and Adebiyi (2010) asserted that education influences adoption of innovation among cocoa farmers in south western Nigeria, hence the respondents in the study area will adopt easily because most of them are educated.

Table 4.1.4 Distribution of Respondents by Education

Education Background	**Frequency**	**Percentage**
Attempted pry. School	11	11.0
Completed pry. School	13	13.0
Attempted sec. school	5	5.0
Completed **s**ec. school	25	25.0
OND/NCE	24	24.0
BSc/MSc etc	9	9.0
No formal education	13	13.0
Total	**100**	**100.0**

Source: Field Survey, 2010.

4.1.5 Religion

The Table 4.1.5 shows that 74.0 percent of the respondents were Christians while 16.0 percent were Muslim and 10 percent traditionalist

Table 4.1.5 Distribution of Respondents by Religion

Religion	**Frequency**	**Percentage**
Christian	74	**74.0**
Muslim	16	16.0
Traditional	10	10.0
Total	**100**	**100.0**

Mean; 1.16

Source: Field Survey, 2010.

4.1.6 Number of years in cocoa production.

All the farmers interviewed were into cocoa production. However, 56.0 percent of the respondents have been in cocoa production for over 25 years while 16 percent had between 21-25 experiences and four percent had between 16-20 years experience also respondents in cocoa farming between 11-15 and 6-10 years were eight percent and 15 percent respectively only one percent had been in farming for less than five years. This is suggestive that the respondents had quite appreciable years of experience in cocoa production which could enable them to take some far reaching decisions in their activities.

Table 4.1.6 Distribution of Respondents Based on Years in Cocoa Production

How long in cocoa production.	Frequency	Percentage
1-5yrs	1	1.0
6-10yrs	15	15.0
11-15yrs	8	8.0
16-20yrs	4	4.0
21-25yrs	16	16.0
Over 25yrs	56	56.0
Total	**100**	**100.0**

Mean; 4.87

Source: Field Survey, 2010.

4.1.7 Annual Income

The result of the study in the Table 4.1.7 below shows that 17.0 percent of the respondents estimated their annual income to be between ₦ 200,000 – ₦ 599,000, 36 percent of the respondents realized ₦ 600 – ₦ 999,000 annually from their Cocoa farming while 47.0 percent of the respondents made an average of between ₦ 1m – ₦ 1.99m and above annually. This shows that the business of cocoa could be viable and returns on investment are encouraging, despite the production challenges.

However, during the focus group discussion (FGD) it was confirm that the farmers that made ₦ 600,000 profits annually have more than two cocoa farms, hence they get laborers to work on the farm and expand their income frontiers. I also observed that most of the respondents that made less than ₦ 600,000 annually were non indigene, hence would have made more than what they are presently making but land is not available.

Table 4.1.7 Distribution of Respondents by Income

Average annual income (₦)	**Frequency**	**Percentage**
200,000 – 599,000	17	17.0
600,000 – 999,000	36	36.0
1m -1.99 and above	47	47.0
Total	**100**	**100.0**

Mean: 2.3

Source: Field Survey, 2010.

4.1.8 Occupation

The Table 4.1.8 below shows that 90.0 percent of the respondents are into Cocoa farming as their primary occupation with two percent of the respondents combine artisan work with cocoa farming while eight percent of the respondents are civil servant but still get involve in cocoa farming. This finding is in agreement with Olajide et al (1999) that farmers engage in other activities apart from farming.

Table 4.1.8 Distribution of Respondents by Occupation

Major Occupation	**Frequency**	**Percentage**
Cocoa Farming	90	**90.0**
Artisan work	2	2.0
Civil servant	8	8.0
Total	**100**	**100.0**

Mean: 1.18

Source: Field Survey, 2010.

4.1.9 Farm Ownership

Table 4.1.9 revealed that 19.0 percent of the respondents purchased their land, 13.0 percent of the respondents rented, 48.0 percent inherited land for cocoa cultivation while 20.0 percent had their families owing the land they are using for cocoa cultivation.

Table 4.1.9 Distribution of Respondents by How They Get Their Farms

How They Got Farm	Frequency	Percentage
PURCHASED	19	19.0
RENTED	13	13.0
INHERITED	48	48.0
FAMILY OWNED	20	20.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.1.10 Respondent' Number of Cocoa Farm

As revealed in Table 4.1.10 , majority of the farmers (40.0 percent) had their cocoa farm in five locations while 39.0 percent had six cocoa farms in different location. Hence, since majority of the respondents cultivate more than a single cocoa farm in different locations. Scattered farm locations would likely be a hindrance to prompt adoption of pollination technique, particularly as it may increase the cost of labour for transportation and workers' wages. This is because; Olayide and Falusi (1975) had earlier opined that fragmented farms were not very suitable for mechanization and other technological practices.

Table 4.1.10 Distribution of Respondents by Numbers of Cocoa farms

How many farm	Frequency	Percentage
7- farms	4	4.0
6- farms	39	39.0
5- farms	40	40.0
4- farms	10	10.0
3- farms	7	7.0
TOTAL	**100**	**100.0**

Mean = 2.77

Source: Field Survey, 2010.

4.1.11 Respondents' Farm Size

The Table 4.1.11 shows that very few cocoa farms in the study area have a large expanse of land to cultivate and this is still one the problem of cocoa farming. The mean farm size was 6.68 ha and only 59.0 percent of the respondents have farm size above the mean, respondents with 1-5 ha of land were 41.0 percent, respondents with 6-10 ha were 45.0 percent, farmers with land between 11-15 ha were 14.0 percent . It important to note that most of the respondents were not real owner of the land but have access to it through lease or rent.

Table 4.1.11 Distribution of Respondents by Farm Size

Size of Farms (Ha)	**Frequency**	**Percentage**
1-5	41	41.0
6-10	45	45.0
11-15	14	14.0
TOTAL	**100**	**100.0**

Mean =6.68

Source: Field Survey, 2010.

4.1.12 Respondents' Farm Outputs

The average output of the respondents was 2.94 tonnes harvest; 17.0 percent of the respondents had only one tonne of cocoa from their farms while 32.0 percent of the respondents produces two tonnes, 11.0 percent of the respondents produces three tonnes while the modal class of the respondents made four tonnes with 34.0 percent and farmers with five tonnes and above were just six percent of the respondent. During the Focus Group Discussion it was found out that the farmers in the modal class are the merchants that have more than five ha of the land.

Table 4.1.12 Distribution of Respondents by Their Output

Tones	**Frequency**	**Percentage**
1	17	**17.0**
2	32	32.0
3	11	11.0
4	34	34.0
>5	**6**	**6.0**
TOTAL	**100**	**100.0**

Mean =2.94

Source: Field Survey, 2010.

4.1.13 Respondents' Sources of Capital

Table 4.1.13 shows that 33.0 percent of the respondents got their capital from their personal savings, six percent from buyers who in most cases would have forced the farmers to mortgage their prices which may affect farmers negatively on the long run if there is astronomical price increase. Cooperatives within the local government offer one percent of the respondents capital, cocoa farming lack adequate financial assistance by commercial banks, only 14.0 percent of the respondents get assistance from commercial banks, the implication of this is that large scale cocoa farming is hindered, large percentage of the cocoa farmers get their capital from esusu/ajo which is 41.0 percent while families and friends were five percent.

Table 4.1.13 Distribution of Respondents' Sources of Capital

Tones	**Frequency**	**Percentage**
Personal savings	33	33.0
Loan from cocoa buyers	6	6.0
Cooperatives	1	1.0
Commercial Bank	14	14.0
Esusu /Ajo	41	41.0
Friends/ Relatives	5	5.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.1.14 Respondents' Sources of Labour

From Table 4.1.14, 17.0 percent of the farmers use family labour, 79.0 percent of the farmers use hired labour which most of them complained is inadequate and where available they are expensive. Four percent of the respondents uses family labour and share croppers for the cultivation of their farms.

Tables 4.1.14 Distribution of Respondents' by Sources of Labour

Size of Farms (Ha)s	**Frequency**	**Percentage**
Family labour	17	17.0
Hired labour	79	79.0
Family/share cropper	4	4.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.1.15 Age of Farms

The Table below shows the distribution of the farms in ages. The number of years a particular farm is engaged is proportional to it fertility. Most of the farms are old, the mean age of the farm was 31.19 and about 42.0 percent of the farms are above the mean, from the table, 93.0 percent of the farms have been in use for 10 years and above this might also give reason why cocoa farm output is declining and need for new ideas of improvement in cocoa farming business.

Table 4.1.15 Distribution of Respondents by Age of the Farm

Age of the farms (years)	Frequency	Percentage
1-9	7	7.0
10-19	22	22.0
20-29	12	12.0
30-39	17	17.0
40-49	21	21.0
50-59	17	17.0
69-69	4	4.0
TOTAL	**100**	**100.0**

Mean=31.19

Source: Field Survey, 2010.

4.1.16 Varieties Planted By Respondents

The Table 4.1.16 shows that most the farmers plant both local and improved varieties of seedlings at their disposal with 72.0 percent of them planting improved varieties e.g (Amazon and Amelonado) while 28.0 percent plant only local variety (criollo).During FGD it was found that the farmers that planted old variety complained that the variety usually grow too tall and has little pod on the cocoa tree, also the beans inside the pods are scanty such that it takes over 50 pods before you can get 1kg, whereas the new variety has a lot of pods on the cocoa tree and the bean in it are many.

Table 4.1.16 Distribution of Respondents by Varieties Planted

Variety	Frequency	Percentage
1	28	28.0
2	72	72.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.1.17 Sources of Respondents' Varieties

Table 4.1.17 Revealed that many respondents (45.0 percent) got their variety of cocoa seedlings they usually planted from their own individual farms. About 41.0 percent of the respondents got their seedlings through ADP, while 14.0 percent got theirs from fellow farmers within and outside the study area. It could be noted that ADP is the rightful place in the state of purchasing improved varieties of cocoa seedling. Seedlings are however, not always available in sufficient quantity.

Table 4.1.17 Distribution of Respondents by Sources of Variety

Sources	**Frequency**	**Percentage**
A.D.P	33	41.0
Personal	60	45.0
Other farms	7	14.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.2 Information Sources by which Farmers became aware of Hand Pollination Technique

4.2.1 Respondent Sources of Information of Hand Pollination Technique

Revelation from Table 4.2.1 shows that farmers' sources of information on hand pollution technique were in this order: radio programmes (36.0 percent fellow farmers (36.0 percent), extension agents (4.0 percent) and agric bulletins (4.0 percent) . This result implies that extension agents did not play much role in dissemination of new cocoa techniques (hand pollination) to the farmers in the study area. This was supported by Adebiyi et al (2006) who reported that low awareness and poor extension linkage with cocoa farmers led to low and non adoption of improved technique

.

Table: 4.2.1 Distribution of Respondents by Sources of Information

Sources of Information on Hand Pollination	**Frequency**	**Percentage**
Extension Agents	13	24.0
Radio programmes	20	36.0
Agric bulletins	2	4.0
Fellow Farmers	20	36.0
TOTAL	**55**	**100.0**

Source: Field Survey, 2010.

4.2.2 Awareness of Hand Pollination by the Respondents

Table 4.2.2 shows that 55.0 percent of the respondents were aware of the technique. During the Focus Group Discussion it was observed that Hand pollination technique was introduced in three local governments in Ondo state with only Idanre as a major pilot area.

Table: 4.2.2 Distribution of Respondents by Awareness of Hand Pollination

Awareness of Hand Pollination	**Frequency**	**Percentage**
Aware	55	55.0
Not Aware	45	45.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.2.3 Years of Awareness about Hand Pollination

Table 4.2.3 shows five percent said they had been hearing about the hand pollination for the past five years, 20.0 percent of the respondents heard about the information of hand pollination four years ago when the state government was projecting the message while 15.0 percent heard about it three years ago, 10.0 percent heard about it two years ago and five percent says less than two years ago. About 45.0 percent of the respondents asserted that they were not aware at all; the implication of this is that the information dissemination about the technology was poor.

Table: 4.2.3 Distributions of Respondents on Years of Awareness of Hand Pollination Techniques

Variables	Frequency	Percentage
Not aware of hand pollination	45	45.0
<2yrs	5	5.0
2yrs	10	10.0
3yrs	15	15.0
4yrs	20	20.0
5yrs and above	5	5.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.2.4: Level of Awareness of hand Pollination based on the Information Sources

Data on Table 4.2.4 shows the best information source in terms of respondents level of awareness on hand pollination technique was from Radio (Mean 2.35). This was followed by awareness created from fellow farmers (Means = 2.30), awareness form extension Agents (Means = 2.05), awareness form Television (Mean = 1.90) and the least level of awareness was from Newspaper (Mean = 1.80). The grand mean is 2.08. Level of awareness with mean score of 2.08 and above are considered to have high Awareness. However, mean scores less than the grand mean are considered to have low awareness. Based on this criteria; the following information sources are classified to have high awareness; awareness of hand pollination from Radio and awareness of hand pollination from fellow farmers.

Table: 4.2.4 Distribution of Respondents based on the Sources of Information and their Level of Awareness.

n=100

Statements on level of awareness of hand pollination	Not Aware Freq. %	Just Aware Freq. %	Aware Freq. %	Much Aware Freq. %	Mean	Standard Deviation
1. Respondents' level of awareness of hand pollination from radio	45(45.0)	5(5.0)	20(20.0)	30(30.0)	2.35	2.1
2. Respondents' level of awareness of hand pollination from fellow farmers	45(45.0)	5(5.0)	25(25.0)	25(25.0)	2.30	2.0
3. Respondents' level of awareness of hand pollination from extension agents	45(45.0)	25(25.0)	10(10.0)	20(20.0)	2.05	1.9
4. Respondents' level of awareness of hand pollination from television	45(45.0)	30(30.0)	15(15.0)	10(10.0)	1.90	1.6
5. Respondents' level of awareness of hand pollination from newspaper	45(45.0)	40(40.0)	5(5.0)	10(10.0)	1.80	1.6
Grand Mean = 2.08						

Source: Field survey, 2010
Parenthesis represent percentage
Freq. = Frequency

4.3 Respondents Cocoa Rehabilitation Practices and Production Strategies

4.3.1 Awareness of Decline In Cocoa Production

During the study all the respondents affirmed that there is decline in cocoa production, the implication of this is that the farmers were aware of the problems of decline in cocoa production and hence were seeking for solution to the present production problems.

Table 4.3.1: Distribution of Respondent based on Awareness of Decline in Cocoa Production

S/N	Responses	Frequency	Percentage
1	There is need for rehabilitation practices	100	100.0
2	There is no need for rehabilitation practices	-	-
	TOTAL		

Source: Field Survey, 2010.

4.3.2 Attitude of Respondents towards Cocoa Production

Table 4.3.2 revealed the awareness of declining in cocoa production by the respondents, hence the respondents were asked to indicate their attitudinal reaction to set of statement by means of categories rating system of Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagree (SD). In other to affirm the position of respondents, about nine statements were made and score. The grand mean is 3.45. The mean values of attitudinal statement of 3.45 and above are considered favoured, while mean values less than 3.45 are considered unfavourable attitude. Based on this categorization, respondents develop favourable attitude (Mean = 4.69) towards the statement "pests and diseases affect production". This means the issues of pests and diseases is an inherent problem of agricultural practices and cocoa is not exception as the respondent viewed in the table attested to this fact, about 69.0 percent strongly agreed.

Also, most respondent (56.0 percent) were strongly agreed with statement that "High cost of agro-chemical affect their production". Respondents also developed favourable attitude (Mean = 4.56) towards the statement. It means the high cost of chemical and inability of the farmers to access the inputs as at when due could affect their production especially in the area of controlling pests and diseases.

In addition, respondents formed favourable attitude (mean = 4.53) towards the statement relating to their age of cocoa farms affecting production , as revealed by 53.0 percent who strongly agreed that old age o cocoa farm affect cocoa production output.

Furthermore, another respondents' favourable attitude (mean = 4.39) is 'shortage of labour affect production'. This revealed that one of the problems of agricultural production is labour. The respondents ascertained during the focus group discussion that

most of the youth are not interested in staying in the rural areas, as they are in the cities looking for white collar jobs.

And lastly, the respondents' favourable attitudes (mean = 3.96) towards a statement 'poor pricing affecting production'. Majority of the respondents (65.0 percent) agreed that poor pricing on cocoa were having negative effect on their income, as the were not able to procure necessary inputs that will enhances their cocoa production.

Conversely, respondents developed unfavourable attitude (Mean = 2.99) about education status. As this is shown that some of the farmers felt that the level of education did not influence cocoa production in the study.

Respondent also claimed that land acquisition for farming affected their cocoa production. Forty nine percent disagree with the position that land acquisition for farming did not affect production. This implies that land tenure system is a problem in the study area, it was observed that the land owner (indigenes) among the respondents were the ones agreed with the statement while the non- indigenes that are actually the major field farmers disagreed because they are finding it difficult to have their own land.

Moreover, respondents developed unfavourable attitude (mean = 1.91) towards the statement relating to sources of information. The position revealed unavailability of reliable information about cocoa affect their production, an indication that the farmers believe or accept that lack of access to information on new technique is an impediments to their production.

The last statement showed unfavourable attitudes (mean = 1.50) on a point that 'Age affects cocoa production'. The statement revealed that 50.0 percent of respondents strongly disagreed that age did not affect level of production. This could be attributed to

the fact that old farmers have experiences and while younger farmers can do more rigorous manual work.

Table: 4.3.2 Attitude of Respondent towards Cocoa Production

n=100

Statements	SA Freq. %	A Freq. %	U Freq.%	D Freq. %	SD Freq. %	Mean	Standard Deviation
i. Pest and disease affect production	69(69.0)	31(31.0)	0(0.0)	0(0)	0(0)	4.69	1.0
ii. High cost of agro-chemical affect your production	56(56.0)	44(44.0)	0(0.0)	0(0)	0(0)	4.56	1.1
iii. Age of cocoa farm affect production	53(53.0)	47(47.0)	0(0.0)	0(0)	0(0)	4.53	1.1
iv. Shortage of labour affect production	42(42.0)	57(57.0)	0(0.0)	0(0)	1(1)	4.39	1.1
v. Poor pricing affect production	22(22.0)	65(65.0)	2(2.0)	9(9.0)	2(0)	3.96	1.5
vi. My educational status affect production	7(7.0)	41(41.0)	7(7.0)	34(34.0)	11(11.0)	2.99	2.1
vii. Land acquisition for farming does not affect production	14(14.0)	11(11.0)	7(7.0)	49(49.0)	19(19)	2.52	2.5
viii. Source of information do not affect production	1(1.0)	9(9.0)	2(2.0)	56(56.0)	32(32)	1.91	1.6
ix. Age affects your production	0(0.0)	0(0.0)	0(0.0)	50(50.0)	50(50.0)	1.50	0.6

Grand Mean = 3.45

Source: Field survey, 2010

Key interpretation

SA = Strongly Agreed, A = Agreed, U = Undecided, D = Disagreed,
SD = Strongly Disagreed

4.3.3 Respondents' Access to Improved Cocoa seedling

Sixty five percent of the respondents have access to improved cocoa seedlings majorly from ADP offices in the local government, while 35.0 percent did not have access because the seedling were not always available whenever they visit the agricultural service centre.

Table 4.3.3: Distribution of Respondents by Access to Improved Cocoa Product

Responses	**Frequency**	**Percentage**
Have Access	65	65.0
Have no access	35	35.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.3.4 Respondents' Previous Cocoa Production Practices

Table 4.3.4 has shows that 58.0 percent of the respondents adopted the cutting down of old trees and replacing with new ones while 42.0 percent said they didn't rather they apply fertilizer.

Ninety five percent of the respondents also engaged in pruning of their cocoa trees during off season and five percent did not use this technique. The implication of the above is that farmers were making effort to improve their cocoa production output and would get more involved in any activity they are aware of.

The third statement is (if the farmer are use to planting of improved varieties Amazon and Amelonado), the Table shows that seventy seven percent of the respondents planted improved varieties of cocoa usually from ADP office while 23.0 percent of the respondents plant local varieties got it from their farms or other farmers.

On appropriate application of fertilizer, 36.0 percent of the respondents agreed that they knew how to apply fertilizer on their cocoa farm while a larger percentage of 64.0 percent said they didn't and would like to learn, if such a program is available.

On appropriate use of agro chemicals, the Table shows that the farmers were exposed to appropriate use of agro chemicals with 65.0 percent said Yes, while 35.0 percent said No, meaning they need training. Some of the farmer said the issue is that the chemicals are actually not available or inadequate.

The sixth statement reads that do respondents allow their cocoa to dry very well. This showsed that 60.0 percent of the respondents were practicing good fermentation/drying techniques while 40.0 percent of the respondents were not doing this. During the focus group discussion the respondents who claim they do not dry well said is

only during high demand. This implies that large number of the respondent still needs appropriate training on effective cocoa processing.

The Table shows that 92.0 percent of the respondents said they did good shade management on their cocoa farm while 8.0 percent were not aware of effective shade management technique.

Timely harvesting of cocoa is crucial to its production, from the Table most of the respondents did harvest on time with about 79.0 percent of the respondents said Yes while 21 percent said No, this could be attributed to the arrangement of share cropping between the farmers and the land owners.

On weed control the Table showed that most of the farmers were aware of weed control and were practicing effective weed control.

Table 4.3.4 Previous Cocoa Production Practices by Respondents

S/N	Statements	Yes %	No %
1	Cutting down of old trees to replace with new ones	58.0	42.0
2	Pruning of old branches	95.0	5.0
3	Planting of improved varieties	77.0	23.0
4	ppropriate fertilizer application	36.0	64.0
5	Appropriate use of agro chemicals	65.0	35.0
6	Good fermentation/Drying method	60.0	40.0
7	Shade Management	92.0	8.0
8	Timely harvesting	79.0	21.0
9	Weed control	99.0	1.0

Source: Field Survey, 2010.

4.3.5 Distribution of Respondents based on the Knowledge of Some Rehabilitation Practices with Hand Pollination

Data of Table 4.3.5 revealed some cocoa rehabilitation practices and how often respondents participated or carried out the practices. The grand mean based on the level of carrying out or exercising the rehabilitation practices is 2.52. Therefore, any mean score above 2.52 favoured the statements and if otherwise did not favour.

Use of decayed plantain stalks that influence breeding ground for midget fly assists in hand pollination , and phase farm replanting ranked first (Mean = 3.25). It means there are availability of plantain stalks remained on their farms, after being used as shading crops in cocoa plantation, as 48.8 percent of the respondents said they always carried out the practice. Phase farm replanting also known as gradual replanting also support with 49.0 percent of the respondents that said they always carried out the practice, the reason could be attributed to the trainings gained through Farmer Field School programme .

Similarly, Integrated Pest Management and Bucket irrigation where stream transverse farm ranked second (Mean = 3.07).

This shows that 45.0 percent of the respondents said they always carried out the IPM practice, and 48.0 percent occasionally carried out bucket irrigation practice respectively. It was observed during Focus Group Discussion that farmers cherished IPM due to lectures they normally received through Farmers Field School in the study area.

Moreover, spraying copper sulphate with lime to avoid destruction of flower cushion ranked Fifth (Mean = 2.48). Thirty three percent said they rarely carried the

rehabilitation. This shows that the majority were not involved in the practice due to the complexity in mixing and spraying the substances.

Selective tree replanting ranked sixth (Mean = 2.23). This shows that 41.0 percent of the respondents rarely carried out the practice. It was observed that during any course of agricultural training, farmers usually find it difficult or adamant to replace their cocoa trees.

Furthermore, complete farm replanting ranked seventh (Means = 2.21). This shows that 39.0 percent of the respondents rarely carried out the practice. A survey showed that majority of the farmers hardly carried out this practice in the study area.

Chupon regeneration ranked eighth (Mean = 2.02), the result shows that majority of the respondents (44.0) never carried out the practice. Also, placing behieves in cocoa farms that produce bees pollinating flowers invariably ranked ninth (Mean = 1.86). The statement revealed that only few of the respondents (7.0 percent) that always carried out the exercise in the study area, this may due to the sophistication involved in doing the practice.

The least ranking for the rehabilitation was improved chupon regeneration by budding and grafting (Mean = 1.76). Forty nine percent of respondents said they never carried out the practice due to the technicality involved in doing bidding and grafting.

Table 4.3.5 Distribution of Respondents Based on the Knowledge of Some Rehabilitation Practices.

N=100

S/N	Statements	Always Freq %	Occasionally Freq.%	Rarely Freq.%	Never Freq. %	Mean	Standard Deviation
a.	Use decayed plantain stalks that influence breeding grounds for midget fly assists in hand pollination	48(48.0)	32(32.0)	17(17.0)	3(3.0)	3.29	1.5
b.	Phase farm replanting	49(49.0)	36(36.0)	6(6.0)	9(9.0)	3.25	1.5
c.	Integrated Pest Management	45(45.0)	28(28.0)	16(16.0)	11(11.0)	3.07	1.6
d.	Bucket irrigation where streams transverse farms	31(31.0)	48(48.0)	18(18.0)	3(3.0)	3.07	1.3
e.	Spraying copper sulphate with lime to avoid destruction of flower cushions	21(21.0)	26(26.0)	33(33.0)	20(20.0)	2.48	1.6
f.	Selective tree replanting	10(10.0)	26(26.0)	41(41.0)	23(23.0)	2.32	1.5
g.	Complete farm replanting	14(14.0)	20(20.0)	39(39.0)	27(27.0)	2.21	1.6
h.	Chupon regenerating	11(11.0)	24(24.0)	21(21.0)	44(44.0)	2.02	1.7
i.	Placing beehives in cocoa farms that produces bee pollinate flowers invariably	7(7.0)	13(13.0)	39(39.0)	41(41.0)	1.86	1.5
j.	Improved chupon regeneration by building and grafting	7(7.0)	11(11.0)	33(33.0)	49(49.0)	1.76	1.5
	Grand Mean = 2.52						

Source: Field Survey, 2010

4.3.6. Respondents' Perception on the Method of Hands

Data on Table 4.3.6 revealed that the grand mean on perception on the method of hand pollination is 1.66. The standard deviation of the twelve statements was very high (ranging from 2. 9 to 5.0) this is as a result of small sample size (55) of respondents that aware and participated in hand pollination technique.

About (73.0 percent) of the respondents strongly agreed with the fact that "hand pollination is easy to perform". The mean value of the respondents is 2.45. This means that the majority of the respondents find it easy to use and perform hand pollination technique. Also, 46.0 percent of the respondents strongly agreed with the statement that hand pollination is a new practice in the study area, with mean value of 2.15. During the field survey, it was discovered that some of the old farmers actually said that the practice was introduced sometimes in the 1990's but not followed up by then government.

In addition, only 46.0 percent agreed to the statement that "my status allows information on hand pollination". The result revealed that most information were always given to farmers' representative who were in most cases politician rather than the practical farmers

Also 46.0 percent of the respondents agreed with the statement that "inadequacy of extension agents affected their inability to adopt hand pollination" with mean score of 2.05. This implies that the role of extension agent is significant and if more achievement is to be made in the study area, more extension agents and efforts need to be deployed.

Furthermore, 55.0 percent of the respondents were at the level of undecided whether farm size is affecting or not their adoption of hand of pollination with mean value of 1.70. Meanwhile, 64.0 percent strongly disagreed that the process involved in

hand pollination is not complex. Also, 64.0 percent with mean value of 1.35 disagreed that “their ages did not affect the usage of hand pollination”. And 55.0 percent of the respondents with mean value of 1.30, disagreed that “their years in cocoa farming did not affect the usage of hand pollination”.

Furthermore, (46.0 percent) strongly disagreed that “their financial status did not affect their easy adoption of hand pollution”. Fifty five percent strongly disagreed that “there was no taboo forbidding them from usage of hand pollution”. Also, 55.0 percent of the respondent, strongly disagreed with the statement that ‘my gender is not affecting being able to adopt hand pollution’.

It implies that any of the gender can carry out hand pollution, provided that he or she understood the procedures involved in hand pollution.

Finally, 54.0 percent of the respondents with mean value of 1.04 strongly disagreed that the morning and evening time of carrying out hand pollution were inappropriate.

Table 4.3.6 Respondents Perception on Method of Hand Pollution

n=55

S/N	STATEMENTS	SA FREQ.%	A FREQ.%	U FREQ.%	D FREQ.%	SD FREQ.%`	MEAN	STANDARD DEVIATION
I	I perceived the method of hand pollination is easy	40(73.0)	5(9.0)	5(9.0)	5(9.0)	0(0.0)	2.45	5.0
ii	Hand pollination is a new practice in my area	25(46.0)	15(27.0)	5(9.0)	5(9.0)	5(9.0)	2.15	4.8
Iii	My status allows information on hand pollination	15(27.0)	`25(46.0)	5(9.0)	5(9.0)	5(9.0)	2.05	4.4
iv	I have perceived inadequate of extension agents affect being able to adopt hand pollination	15(27.0)	25(46.0)	5(9.0)	5(9.0)	5(9.0)	2.05	4.4
v	My farm size is not affecting the adoption of hand pollination	5(9.0)	10(18.0)	30(55.0)	5(9.0)	5(9.0)	1.70	3.4
vi	The complexity of process is not affecting my adoption of hand pollination	10(18.0)	10(18.0)	0(0.0)	10(18.0)	25(46.0)	1.35	4.2
vii	My age is affecting usage of hand pollination	5(9.6)	5(9.0)	5(5.0)	`35(64.0)	5(9.0)	1.35	3.1
viii	My years in cocoa farming is not affecting usage of hand pollination	5(9.0)	5(9.0)	5(9.0)	30(55.0)	10(18.0)	1.30	3.2
ix	My financial status is not affecting my easy adoption of hand pollination	5(9.0)	5(9.0)	5(9.0)	15(27.0)	25(46.0)	1.15	3.4
x	There is a taboo forbidding me for usage of hand pollination	5(9.0)	5(9.0)	10(18.0)	5(9.0)	30(55.0)	1.15	3.5
xi	My gender is not affecting being able to adopt hand pollination	5(9.0)	5(9.0)	5(9.0)	10()18.0	30(55.0)	1.10	3.9
xii	I am not okay with the time of carrying out hand pollination	2(4.0)	5(9.0)	8(15.0)	10(18.0)	30(54.0)	1.04	2.9
	Grand Total = 1.66							

Source: Field survey, 2010

Freq = Frequency

% = Percentage

4.4 Constraints facing Cocoa Farmers

4.4.1 Distribution of Respondents Based on Constraints to their Farm Production

According to the respondents in the study area , many constraints were encountered in the course of their cocoa production. From Table 4.4.1 , 68.0 percent complained of low extension contact. As it was also revealed by the table 4.4.1, 61.0 percent claimed that they had constraints in procuring improved cocoa varieties in the study area.

About 81.0 percent of the respondents said that they had credit facilities problem while 19.0 percent said they had no problem with credit facilities . The responses of majority of the respondents having problem with credit facilities ranging from private, public and government usually asked for collateral security before loans would be given out in the study area. Therefore without the provision of credit facilities to cocoa farmers they may not be able to embark on mechanized (commercial) production system. As well they would not buy the idea that would lead to adoption of hand pollination techniques.

Moreover, one of the enumerated problems is a problem associated with pests and diseases, the majority (72.0 percent) said they had problems with these. The growth of pests and diseases is favoured by the atmospheric relative humidity in the study area. Land tenure systems that normally leads to fragmentation of land that invariably affected potential farmers to expand their cocoa farms is another problem, as claimed by 57.0 percent of the respondents.

The table revealed that 69.0 percent of the respondents had problem with depletion of soil (fertility) nutrients and this will invariably results to low yields of cocoa, and extra cost incurred by the farmers on fertilizer.

Beside aforementioned problems, 59.0 percent stressed that transportation was a problem. This is attributed to the bad roads and higher transport fare charged by the motorists in the study area.

Lastly but not the least enumerated problems was low input supply as stressed by about 67.0 percent of the respondents. The input supply ranging from herbicides, pesticides, fertilizer, hardware (pump, rain boots, and raincoats), cutlasses, hoes, axes were not readily available, those that were available were very expensive in the study area.

4.4.1 Distribution of Respondents Based On Constraints To Their Cocoa Production

		Yes		No	
N/S	**Constraints**	**Freq**	**%**	**Freq**	**%**
1	Low extension contact	68	68.0	32	32.0
2	Lack of improved cocoa varieties	61	61.0	39	39.0
3	Credit facilities problems associated with request for collateral security	81	81.0	19	19.0
4	Pests and diseases problems	72	72.0	18	18.0
5	Land tenure system	57	57.0	43	43.0
6	Depletion of soil nutrients\	69	69.0	31	31.0
7	Transportation problem	59	59.0	41	41.0
8	Low input supply	67	67.0	33	33.0

Source: Field Survey, 2010.

4.5 Adoption of Hand Pollination Technologies by Respondents

4.5.1 Adoption of Hand Pollination Techniques

The Table below shows that 45.0 percent were not aware of hand pollination technique while 53.0 percent were aware and have adopted it while two percent said they were aware but have not adopt it.

Table: 4.5.1 Distributions of respondents on Adoption of Hand Pollination

Variables	Frequency	Percentage
Not aware of hand pollination	45	45.0
Aware and Adopted	53	53.0
Aware but did not adopt	2	2.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.5.2 Reason for Adoption of Hand Pollination Techniques

Forty five percent of the respondents were not aware of the technique while 5.0 percent of those who were Aware have Adopted the technique because they found it easy to practice, 20.0 percent adopted because it increases their yield and 30.0 percent says because it increases their level of income.

Table: 4.5.2 Distributions of Respondents on Why They Adopt It

Variables	**Frequency**	**Percentage**
Not aware of hand pollination	45	45.0
Easy to produce	5	5.0
Increase in my yield	20	20.0
Increase my income	30	30.0
TOTAL	**100**	**100.0**

Source: Field Survey, 2010.

4.5.3 Factors Affecting the Use of Hand Pollination

Seventy three percent of the respondents asserted that the knowledge of hand pollination technique affected their use of hand pollination, nine percent asserted that cost of practicing it, 9.0 percent says fear of practicing it, during the FGD the respondents said their fears is that the pollination method might fail while nine percent says the complexity of the practice i.e. how to identify the pollen grain etc. The Table helped us to know that the information of this technique was not disseminated to the farmers very well, because the pollination activity is actually easy, not complex and cheap. It then implies that much success would have been made if the farmers were thought the techniques very well. However the few respondents that practiced it attested to the greater output of their production compare to the previous practices of natural pollination.

Table: 4.5.3 Distributions of respondents on Factors Affecting the of Hand Pollination

Variables	**Frequency**	**Percentage**
The knowledge	40	73.0
Cost of practicing it	5	9.0
Fear of practicing it	5	9.0
Complexity of the practice	5	9.0
TOTAL	**55**	**100.0**

Source: Field Survey, 2010.

4.5.4 Factors Affecting Respondents Level of Adoption

Here, respondent were asked to indicated their reaction to a set of factors to show the level of which certain factors affecting their decision to adopt hand pollution technique in cocoa production by means of four categories rating system of Always = 4, Occasionally = 3, Rarely = 2 and Never = 1. The grand means is 2.76, and any mean value of the statements that greater than (2.76) is considered favoured as factor affecting the adoption hand pollution technique but any mean value of the statements, that less than (2.76) is considered unfavoured as factor not affecting the adoption of hand pollution technique. Base on the categorization, availability of finance was ranked first with mean value of (3.35). This shows that majority of respondents would always adopted hand pollution if they could have access to credit and loans that could help them to procure hand pollution materials, hire labours and buy other things associated with the practice.

Availability of labour ranked second with thee mean value of (3.26). Majority of the respondents stressed that they would always adopted hand pollution technique if there were enough man power or labnour that could helps during the operational steps involved in the practice.

Availability of hand pollution materials ranked third with the mean value of (3.08). This is the major key factor in hand pollution technique, because without thee availability of hand pollution materials nothing can be done.

In addition, exposure to reliable source of information was ranked forth with the mean value of (3.05). This shows that the majority of the respondents considered source of information and knowledge as an important factor that would make them to adopt hand pollution technique in the study area.

More also, cost of practicing favoured the adoption of hand pollution techniques with mean value of (3.02). About 39.0 percent of the respondents said they would occasionally adopt hand pollution if money they would incurred into the practice is not much.

Weather conditions was unfavourable factor that affecting the adoption of hand pollution with the mean value of (2.52), 35.0 percent of the respondents said they would never adopt the practice if weather condition could not favour them.

Age of coca was ranked seventy and unfavoured factor that affecting the adoption of hand pollution technique with mean value of (2.37). This implies that the majority of the respondents would not adopt hand pollution if cocoa tree at any age (young or old) did not favour the practice.

Furthermore, pests and diseases control with he mean value of (2.24) was unfavourable factor that affecting the adoption of hand pollination technique. This implies that most of the farmers would not adopt hand pollination in as mush they could not control pests and diseases that might associate with it.

The last was complexity of the practice with the mean value of (1.92) was also unfavourable factor affecting the adoption of hand pollution if they would not understand the technical-know-how of the practice for example how to identify the pollen grains, select compactible cocoa trees and so on.

Table 4.5.4: Distribution of Respondents based on Factors Affecting their Level of Adoption

S/N	STATEMENT	Always Freq. %	Occasionally Freq. %	Rarely Freq. %	Never Freq. %	Mean	Standard Deviation
a)	Availability of finance	51(51.0)	36(36.0)	10(10.0)	3(3.0)	3.35	1.6
b)	Availability of labour	59(59.0)	25(25.0)	9(9.0)	7(7.0)	3.26	1.5
c)	Availability of hand pollination materials	39(39.0)	38(38.0)	15(15.0)	8(8.0)	3.08	1.7
d)	Exposure to reliable source of information	43(43.0)	32(32.0)	16(16.0)	10(10.0)	3.05	1.3
e)	Cost of practicing	38(32.0)	39(39.0)	10(10.0)	13(13.0)	3.02	1.3
f)	Weather conditions	32(32.0)	19(19.0)	18(18.0)	31(31.0)	2.52	1.6
g)	Age of cocoa	20(20.0)	17(17.0)	43(43.0)	20(20.0)	2.37	1.6
h)	Pests and diseases control	18(18.0)	9(9.0)	52(52.0)	21(21.0)	2.24	1.6
i)	Complexity of the practice	9(9.0)	21(21.0)	31(31.0)	39(39.0)	1.92	1.5
	Grand Mean=2.76						

Source: Field survey, 2010.

Freq = Frequency

% = percentage.

4.6 Hypotheses Testing

Ho_1: There is no significant relationship between the socio-economic characteristics of the respondents and their adoption of hand pollination.

The empirical result of the multiply regression as presented in Table 4.6.1. The R^2 is 0.737 which implies that about 73.7% of the variations observed in the adoption of hand pollination techniques jointly predicts or explain reasons why farmers adopt hand pollination techniques. The F-ration (18.126) is significant at 0.05 level. This shows that the variable in the model present a reliable goodness-of-fit at 95% confidence level. Also, the standard errors of the estimate are generally low, ranging between 0.141 and 0.646. This suggests that there is low multicollinearity between the independent variables and that the sample size was reasonable and taken from a normal distribution population.

Also Table 4.6.1 reveals that income of the farmers, level of the education, years of experience; cocoa farm size and household size are socio-economic factors that influence adoption of hand pollination techniques.

The implies that, the more the farmers income increases, the more they will be able to afford hand pollination materials, hire labour and have the tendency to buy other things that involved in hand pollination. Generally capital is needed for purchase of farm input, labour , land etc.

Level of education of farmers is also significant because the farmers with highest level of education will be able to adopt hand pollination method that required technical-know-how and other management practices.

Years of experience of cocoa farmers is also significant because the farmers experience over the years have enable him, master the intricacies involved in cocoa production viz-a-viz the developed technologies (hand pollination) required.

The result also showed that cocoa farm size is significant, that is, when the farm size are large, there is a tendency that the income will increase and this will bring higher potential for the farmers to adopt hand pollination technology.

Lastly household size also influence the adoption of hand pollination techniques. The higher the family size in cocoa production the better the amount of man power and family labour spent in production, an acceptability of an innovation depends on family size.

The other variable that was not significant include age of the cocoa farmers. Age of the farmers which was expected to be significant was not and this might be attributed to the fact that experience in cocoa farming was not very relevant in the adoption of hand pollination technique which has not been practiced until recently.

Table 4.6.1: Stepwise Regression Analysis on Relationship between Socio Economic Characteristic and Adoption of Hand Pollination

Variable	**Regression co-efficient**	**Standard error**	**T-value**	**P. Value**	**Decision**
Constant	3.60	0.646	7.43	0.010	S
Income of farmers	1.67	0.224	3.84	0.000	S
Level of education	0.24	0.071	4.59	0.005	S
Years of experience	-0.65	0.129	5.84	0.000	S
Farm size	-0.351	0.098	-3.51	0.000	S
Household size	0.486	0.141	2.609	0.016	S
R^2=0.737					
Adjusted R^2= 0.713					
F-ratio=18.126					

*Significant at 0.05 level

S=significant

4.6.2 Binary Logistic Regression

Binary stepwise logistic regression analysis was also employed to investigate the hypothesis one which states that there is no significant relationship between the socio-economic characteristics of the respondents and their adoption of hand pollination.

The dependent variable Y is the adoption which is binary variable. Those that adopted hand pollination techniques are coded 1, while those who did not adopt hand pollination are coded 0.

The following independent variables were fitted into binary regression model in order to influence their influence on the adoption of hand pollination technique.

A. Age of the farmer
B. Annual income
C. Source of capital
D. Level of education
E. Age of the farm
F. Farmer's output
G. Types of crop planted

The stepwise logistic regression method selected annual income, source of capital, age of the farm, farmers output and types of crop planted as the significant variable that determine the probability of adopting hand pollination technique based on the wald statistics.

Age and level of education of farmers were the (2) postulated regressors, that found not significant on the adoption of hand pollination.

Table 4.6.2 showed also the model chi-square, which is 112.646, is significant at 0.05 level. The general predictive power of the model was high as revealed by the pseudo efficient (R^2) of determination which was about 0.813.This implies that about 81.3% of the variations in the probability of adoption are jointly determined by five out of seven variables fitted into the model using stepwise logistic regression method.

From result in table 4.6.2 the empirical model derived from the analysis could be stated as follows:

Logit (p)= 0.866 +0.608, +-0.226 X_2 +-0.207 X_3 + 0.050X_4 + 0.240 X_5 + 0.370X_6 +-0.457X_7.

The implication of the result is that, as the farmers amount income increase, the more they will be able to adopt any innovation and as well be able to afford the cost of purchasing materials and equipment needed in the innovation.

The result also showed that age of the farm is significant, that is if it is young cocoa trees that are relevant in practicing hand pollination they will be readily available, and reverse in the case, if it is old cocoa trees that are relevant in practicing hand pollination they will be also readily available. But according to Adegeye (2003), old cocoa trees should be cut off and replanted at 20-25 years of age.

Source of capital also influenced adoption of hand pollination. The more farmers have access to credit facilities, the more they are able to afford the cost of technology they require for their production. Capital is needed for purchase of farm input, labour, land and so on.

Farmers' output especially the one with higher profit after the consideration of marginal cost (income-expenditure) will influence farmers to easily adopt technologies (hand pollination), combine with their attitude and perception about the technology.

Types of occupation justified the significance of adoption of hand pollination technique in the study area. Those farmers that cultivated solely cocoa will be having interest to adopt any technology that have to do with the enhancement of the cocoa production.

Table 4.6.2: Empirical Result of Binary Regression Model

Variable	**Logit co-efficient**	**Standard error**	**Wald statistic**	**Significant level**
Constant	0.566	0.641	6.375*	0.079
Age of the farmers	0.608	0.803	0.037	0.035
Animal income	-0.226	0.220	8.852*	0.35
Source of capital	-0.207	0.321	8.662*	0.009
Level of education	0.050	0.201	0.029	0.004
Age of the farm	0.240	0.219	9.778*	0.000
Farmers' output	0.370	0.001	6.102*	0.002
Types of crop planting	-0.457	0.071	9.744*	0.042
Model chi-square=112.646 R^2=0.813				

Significant at 0.05 level.

4.6.3 The Second Hypothesis Stated that there is no Significant Association Between Sources of Information on Hand Pollination Technique by the Respondents and Their Adoption of the Technique.

Chi-square was used to analyze hypothesis HO_2.

Farmers level of adoption of hand pollination versus extension agents. The X^2 Calculated (9.114) is less than X^2 Table value (14.07). Therefore there was no significant association between farmers' level of adoption of hand pollination technique and access to extension agents. This implies that extension agent's visitation did not influence the level of adoption of hand pollination by the farmers.

Farmers level of adoption of hand pollination versus Radio program/Tv. The X^2 Calculated (15.468) is greater than X^2 Table value (14.07). Therefore there was significant relationship between farmers level of adoption of hand pollination and access to Radio and Tv programmes. This shows that Radio and Tv programme influence adoption of hand pollination technique by the farmers.

Farmers level of adoption of hand pollination versus agricultural bulletins. The X^2 Calculated (16.019) is less than X^2 Table value (36.67). There was no significant relationship between farmers level of adoption of hand pollination techniques and access to agric bulletins. This implies that farmers living in study areas could not easily have access to agric bulletins that could bring about relevant information on hand pollination technique. Therefore farmers may not adopt the technique they know not much about.

Farmers level of adoption of hand pollination versus fellow farmers as source of information. The X^2 Calculated (14.481) is greater than X^2 Table value (36.67). Therefore there was significant association between farmers' level of hand pollination

technique and access to fellow farmers. Uunder favorable conditions information (Van den Ban,1998) transfer fast through fellow farmers more than any other sources of information. This variable highly supported that farmer get information that related to hand pollination method easily from fellow farmers in the study area.

Table 4.6.3 Chi-square Analysis Showing the Relationship between Sources of Information and Adoption of Hand Pollination Techniques

Variables	X^2 cal	X^2 Tab	df	Remarks
Farmers level of adoption of hand palliation versus extension agents (ADP)	9.114	14.07	7	NS
Farmers level of adoption of hand pollination versus Radio / Tv programmes	15.468	14.07	7	S
Farmers level of adoption of hand pollination Versus agric bulletins	16.019	36.67	21	Ns
Farmers level of adoption of hand pollination versus fellow farmers as source of infomation.	41.481	36.67	21	S

Source: Field Survey, 2010.

Probability is at 5% level

DF= Degree of Freedom

S=significant

NS=Not significant.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Findings

The study was carried out to determine factors affecting the adoption of hand pollination technique by cocoa farmers in Ondo State (Idanre and ileoluji/okeigbo L.G.A as a case study). The study was motivated by the declining in cocoa production in Nigeria and specifically Ondo State in recent time.

In view of the afore-mentioned observation, this study therefore, aimed at finding from cocoa cultivating farmers in Ondo State (Idanre and ileoluji/okeigbo L.G.A), the socio-economic characteristics of respondents, the information sources by which they become aware of uses of improved technologies such as hand pollination, the various cocoa production and rehabilitation strategies used in the study area, the various constraints faced by cocoa farmers in adopting hand pollination techniques and to identify specifically, the factors that were enhancing the adoption of hand pollination technology by the respondent.

One hundred respondents were randomly selected from the ten communities at Idanre and ileoluji/okeigbo Local Government for this study. Information relevant to achieve the stated objectives were collected from structural interview schedule. Secondary data were however sourced from texts, journals, monographs e.t.c. The result of the finds revealed among other that, majority of the respondents were between the ages of 51 and 60 years with a total 30.0 percent while 2.0 percent were below 20 years.

Ninety percent of the respondents (90.0 percent) were male while 10.0 percent were female. Majority of them (75.0percent) were married. The results revealed that

majority of the respondents (87.0 percent) have one form of education or the other while 13.0 percent had no formal education. Majority (74.0 percent) were Christians in the study area. The findings further revealed that majority of the respondents (58.0 percent) have been in cocoa production over 25 years. Majority of the respondents (47.0 percent) earned their average annual income within the range of ₦1m to ₦1.99m and above.

Ninety percent were cocoa farmers and 48.8 percent inherited their farms. Higher percentage of the respondents 41.0 percent usually gets their capital through Esusu/Ajo while 1.0percent of the respondent got through cooperative societies.

Forty five percent were not aware of hand pollination in the study area. Thirty six percent said they got their source of information about hand pollination through radio, as well 36.0 percents of the respondents said they got their information about hand pollination through fellow farmers while 24.0 percent got the information through extension agents, this means majority (30.0percent) of the respondents do not have access to extension agents.

All of the respondents (100.0percent) were aware of the decline in cocoa production and they opined that there is need for rehabilitation practices. Forty two percent of the respondents strongly agreed with the fact that shortage of labour was affecting production. Seventy three of the respondents strongly agreed with the fact that hand pollination is easy to practice. Based on the findings, it was observed that, 68.0 percent had constraints of low extension contact, constraints in processing improved cocoa varieties showed by 61.0 percent, credit facilities problem showed by 81.0 percent. Majority of the respondents (72.0 percent) had problems associated with pests and

diseases, land tenure system problem claimed by (57.0 percent) of respondents, low input supply should be 67.0 of the respondents.

Forty five percent of the respondents were not aware of hand pollination, 53.0 percent were aware and adopted while 2.0 percent were aware but did not adopt it.

Six factors out of the nine factors postulated showed the level of adoption of hand pollination is significant.

Multiple regressive analysis revealed that annual income of the farmers, level of education, years of experience, cocoa farmer size and household size are socio-economic factors that influence adoption of hand pollination techniques. The only variable that was not significant in the analysis was age of the cocoa farmer.

Stepwise logistic regression selected annual income, source of capital, age of the farmer, farmers output and types of crop planted as the significant variables that determine the probability of adopting hand pollination techniques based on the wald statistics.

The chi-square analysis of hypothesis two also showed that, there was no significant relationship between access to extension agent (ADP), agricultural bulleting and farmers' level of adoption of hand pollination techniques.

5.2 Conclusion

Having considered various findings with respect to factors affecting the adoption of hand pollination techniques by cocoa farmers. The summary of the result in this case favourably support the acceptability and adoption of previous cocoa production practices by respondents and stated statement on level of adoption respectively.

From the study, it can be said that most of the farmers had no access to agricultural extension services, and 45.0 percent said they were not aware of hand pollination and these were affecting their cocoa production. The study also confirmed that most of the farmers (100.0 percent) affirmed that there was a declining in cocoa production and hence were seeking for solution to the present production problems.

The study showed that credit facilities problem were the major constraints to the cocoa farmers. The study also revealed that majority of the farmers had problems of pests and diseases.

Based on the finding of this study, it becomes evident that production by natural pollination and production strategy of raising cocoa are inefficient and farmers in this case show greater potential for adoption of hand pollination techniques of cocoa vis-à-vis the use of new production practices.

Therefore, this study has contributed in no small measure to present drives towards increased cocoa production by way of providing relevant information on sustainable methods of cocoa production strategies that are adaptable to farmers for increased production.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made:

1) Government, non government organization, bank of agriculture, bank of industries should provide funds as source of credit and loans with soft policy so as to allow farmers easy access to credit facilities, this will assist the cocoa farmers to be financially buoyant in order to buy inputs needed for the newly adopted technologies.

2) Agro-industries, agricultural service centre and inputs supply agency should make available insecticides, germicides, pesticide and other chemicals close to the cocoa farmers in study area. This will help the farmers to overcome some of the problems they faced in course of pests and diseased during the cocoa production.
3) There is the need for government to employ more extension, workers and also encourage non-government organization/private institutions to be more involved in extension work so as to reduce extension/farmers ration.
4) There is need to provide the input, supply and delivery system through efficient distribution network so as to back up innovation (hand pollination), being introduced to the farmers for adoption, such input should be readily available and accessibly to the farmers. This step will remove some of the constraints farmers have in adopting cocoa-based technologies.
5) Researchers should work closely with extension while developing the technologies so that farmers could reduce, the complexities in some of the technologies so as to enhance adoption.
6) Rehabilitation of farmers farm which will be down by field officers and ADP extension workers who will identify cocoa farmers who would release their old farms for rehabilitation.
7) The issue of the land tenure problem should be addressed as this is one silent but prevalent problem of cocoa production. Sensitilization, of landowners to either release or sell part of their land for aggressive cocoa production would be welcome development.

REFERENCES

Adebayo, J.O. (1995): The impact of Trade liberation on the production and marketing of Cocoa in Ondo State "An Unpublished MBA Thesis of the Dept. of Management and Accounting, Obafemi Awolowo University, Ile-Ife. Pp. 18-19

Adegbaro, A.J, (1972): Export Potentials of Cocoa in Nigeria. A paper presented at the National Workshop on Re-positioning of Nigeria Agriculture for Export: Project and Challenges. ARMTI Ilorin, Nigeria.

Adegbaro, A.J. (1973): Nigeria Agriculture: Reaping where we do not sow. Department Lecture, Agricultural Economic Department, University of Ibadan, Ibadan.

Adegeye, A.J. (2003): "Achieving a revolution in Cocoa Production in Ondo State". A paper presented at a seminar on cocoa organized by the FUTA Venture in conjuction with school of agriculture and agricultural technology held in FUTA, Ondo State, 13-14 October, 2003

Adenikinju S.A (1988): Weed control on a poorly established mature cocoa plot with Gramoxone and round up in book of abstracts, 16th Annual Conference, Weed Science Society of Nigeria, 27th Nov. – 1st Dec. 1988, Obafemi Awolowo University, Ile-Ife.

Adenikinju, S.A, (1999): Pollen compatibility and method of hand pollination. Worldcocoafoundation.org/up.

African Journal of Biotechnology (2005): Volume 4, No. 2, February 2005, Pp. 143-150.

Agbamu, J.O. (1995): Analysis of farmer's characteristics in relation to adoption of soil management practices in the Ikorodu area of Nigeria. Japanese Journal of Tropical Agriculture, 39(4): 213-222.

Ajibefun, I.A., G.E. Battese and A.G. Daramola (2002): Determinants of Technical Efficiency in Smallholder Food Crop Farming: Application of Stochastic Frontier Production Function, Quarterly Journal of International Agriculture 41 (3), Pp. 225-240.

Akinola, A.A. (1986): An application of bass' model in the analysis of diffusion of cocoa-spraying chemicals among Nigerian cocoa farmers. Journal of Agricultural Economics, 37: 395-404.

Alfred S.D.Y (2002): Socio- Economic factors affecting rice production by women farmers in Ondo-State. Ogun journal of Agricultural science. Vol. 11. Pp 151-165.

Anon (1995): Report on causes of recent decline in cocoa production in Ghana and measures to revamp the industry. Office of the president, Accra: 103pp.

CAN (2005): Cocoa Association of Nigeria Quarterly bulletin, publisher CAN Secretariat, June 2005.

CBN (1995): Integrated production and protection practices of cocoa in Nigeria. www.jol.info/../47a67.

Cook R. J. (1986): Inter-relationship of plant health and the sustainability of Agriculture with special reference of plant disease. Amer.J.Alternative Agric.1:19-24

Cruz F.A. (1987): Adoption and Diffusion of Agriculture Extension.

FAO (1996): Production year book, Vol. 50. Rome: Food and Agriculture of the United Nations.

FAO (l994): The Technologies Application Gap: overcoming constraints to small farm development F.A.I.U.N.O, Rome Pg. 17.

Feder, G., R.E. Just, D. Ziberman (1985): Adoption of agricultural innovations in developing countries: A Survey. Economic Development and Cultural Change 33(2): 255-298.

Folayan, J.A., G.A., Daramola and A.E., Oguntade (2006): Structure and Performance Evaluation of Cocoa Marketing Institution in South-Western Nigeria: An Economic Analysis. Journal of Food, Agriculture and Environment. 4(2): 125-128.

Havelock, R.G. (1976): Planning for Innovation through Dissemination and Utilization of Knowledge. Ann arbor, Midigan, University of Midigan 113.

ICCO (International Cocoa Organization (2004): Quarterly Bulleting of Cocoa Statistics, Vol. XXIX. No. 4, www.ICCO.org.

Idachaba, F.S (2000): Agriculture policy process in Africa; Role of policy Analysis ECA paper monograph series 2, Uganda.

Idachaba, F.S., K., Nyavor and N.O., Egiebor (1999): Food policy for the poor; expanding the research frontiers. www.iffor.org/pubs/books/doc 48/pdf.

Idowu, O.J., H.M. Van Es, G.S. Abawi, D.W., Wolfer, J.I., Ball, B.K. Gugino and A.V. Bilgili (2007): Effects of market deregulation on cocoa production in south-west Nigeria. African Journal of Agricultural Research Vol. 2 (9): 429-434.

Ingold Tim (2002): the perception of the Environment, Essays in Livelihood, Dwelling and Skills.

Kayode M.O and Usman T.B (1985): Proceeding of the national conference on Nigeria since independence vol. 11. The Economic and social development of Nigeria.

M.C Quail, D and S Windhal (1981): Communication Model for the students of mass communication, London. Longman Group p.12.

Norman, S., LEWIN, S., SWART, T. and Volmink, J. (1988): What's wrong with the diffusion of innovation theory. The case of a complex and networked technology. INARDIS, M.A. and MARCOLLIN, B.L. (Eds.) Diffusing software product and Process Innovations. Norwell, MA, Klower Academic Publishers.

Odeh O.O. (1991): Review of results of fertilizer trial in Nigeria 8th International Cocoa Research Conference Proceedings Cartagena P. 171-174.

Ogunfiditi, T.O (1981): Adoption of improved practices. A choice under uncertainty, indian journal of Extension Education vol.18 (1 and 2) Pp33-35.

Ojo A. (2005): Makanre News Quarterly Bulleting, Vol. 2, No. 1, Business Supply Limited Idanre Ondo State.

Ojo, A. (2005). Reflection on the Nigeria Cocoa Economy. Precious Pearls Books. Akure, Nigeria. Pp192.

Okunlola, J.O. and Adebiyi O.A. (2010): Radio Agricultural Programme and Technology Adoption among Food Crop Farmers in Ondo State CITADEL Vol. 1. No. 2 Page 248-258.

Okunlola, J.O. and Adekunle, O.A. (2000): Indigenous Knowledge Approach for Rice Pests and Disease Control by Rice Farmers in Nigeria for Sustainable Environmental Extension (JEXT), 1 (1): 28-30.

Olaiya A.O., Hammed, L.A and Famaye (2003): Yield Evaluation of Cocoa Rehabilitation through Coppicing. A paper presented at 14th International Cocoa Research Conference, Accra, Ghana 13-18 October, 2003.

Olajide, S.O. and A. Falusi(1975): Economic of Cocoa Production. In Proceeding of international Cocoa Research Conference, Ibadan, Nigeria. Pp. 12-17.

Olayemi, J.K (1974) Cost and Returns of cocoa and Alternative crops in western Nigeria. Kotey et al (EDS); The Economics of Cocoa Production and marketing. Proceeding of Cocoa Economics Research conference. Legon, Ghana. Pp 48-59.

Olayemi, J.K and S.O Olayide (1981) Elements of applied Econmerics. Published by card and printed by les shyraden Nigeria limited (printing Division). Pp 219-240.

Opeke, L.K (2003). Increasing Cocoa Production in Nigeria during the third millennium in vocational publication no 2. CAN Pp 24-32.

Opeke, L.K. (1982): Tropical Tree Crops. Vail Balleu Press Inc., Binghamton, N. Y.

Opeke, L.K. (1987): Tropical Tree Crops, Spectrum 12. Adamu, C.O., C.I. Sodiya and J.M. Awotinde, 2006. Book Ltd. Ibadan, Pp. 108-120.

Osei J.K. (1993): Construction of Low Density Linkage Map of Theobroma Cacao L. using random applied DNA Markets Ph.D Thesis University of Pennsylvania.

Osuntogun, N. and R. Adeyomo (1986): Adoption of new innovations and the role of cooperative credit in the production of rice. In: Okeke, O. (eds.). Cooperatives and Nigerian Economy. Dept. Agric. Econo. University of Nigeria Press, Nigeria.

Rhoades, R.E and R.H. Booth (1992): Farmer-Back-To-Farmer. A model for generating acceptable Agricultural Technology and Agricultural Administration vol.11Pp127.

Rogers E.M (1983): Diffusion of innovation 3rd edition. Free press, New York. 339p.

Rogers E.M. and F.F Shoemaker(1971): Communication of Innovations. A cross cultural approach 2nd edition. Free press New York. Pp21-37.

Rogers, E. (1962): Diffusion of innovation New York. Free Press of Glencoc. Pp 87.

Shoemarker, F.F. (1971): Communications of Innovations, New York: The Free Press.

Stanfield, D. J. (1988): "Adoption and Diffusion of New Product," in Applications of the Sciences in Marketing Management, eds. Bass_Frank, King, C.W. and Passemier, E.A., New York: John Wiley.

Van Den Ban, A. (1998): Supporting Farmers' decision-making process by Agricultural Extension. Journal of Extension system 14: 55-64.

Williams C.E and S.K.T. Williams (1984). Agricultural user population and their needs. A case study of Badeku Pilot rural development Project in Nigeria. A dvancing Agricultural Production in Africa. Proceedings of CAB First scientific Conference Anisha. Tanzania 12-18 febuary, 420p.

Wood, G.A.R and Lass, R.M. (1989): Cocoa 4th edition Longman Group, London page. 211-229.

World Bank, (2006): Poverty in the mist of plenty: Challenge of growth with inclusion. A lworld Bank Poverty Assessment, population and Human Resources Division.