UNIVERSITY OF CAPE COAST

FARMERS' PERCEPTION OF THE CONTRIBUTION OF MAIZE FARMING TECHNOLOGIES TO LIVELIHOODS IN THE BUEA SUB-DIVISION OF CAMEROON

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature..... Date.....

Name: Stella Ahone Ntoko

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature..... Date.....

Name: Prof. J.V. Mensah

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ABSTRACT

The main objective of the study was to examine farmers' perceptions of the contribution of maize farming technologies to livelihoods in the Buea Sub-Division of Cameroon. The specific objectives dealt with farmers' demographic characteristics and their use of maize technologies, farmers' views of other factors that influence their use of maize technologies, a comparison of the yields, incomes and livelihood perceptions of farmers who use traditional technologies and those who use improved technologies, and the roles played by extension officers in enabling farmers to adopt and diffuse maize technologies.

The study covered 215 farmers who were selected using the simple random sampling technique, while all four extension officers in the sub-division were interviewed. Structured interview schedule and questionnaire for the farmers and extension officers respectively, were employed as the instruments for data collection. The chi square test of independence, mann-whitney u test, cross tabs, pie charts and bar graphs were the methods of data analysis used to analyse and present the results.

Results from the study revealed that farmers who used improved maize technologies had higher yields, incomes and better perceptions of their livelihoods than their counterparts who used traditional maize technologies. Among the recommendations made were that farmers should press for the subsidisation of improved maize technologies and training sessions organised by extension officers. This would enable more farmers to have access to the services of the officers and adopt improved technologies to obtain higher yields, incomes and have better perceptions of their livelihoods.

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DEDICATION

To my parents, Mr and Mrs. Thomas Ntoko, my late elder brother, Fred Ntoko and younger brother, Julius Ntoko.

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APCVA	American Peace Corps Volunteer Association
BSDDARD	Buea Sub Divisional Delegation for Agriculture and Rural Development
CIMMYT	International Centre for Maize and Wheat Improvement
DFID	Department for International Development
FAO	Food and Agriculture Organization
IRAD	Institute of Agricultural Research for Development
IWM	Improved White Maize
IYM	Improved Yellow Maize
MARD	Ministry of Agriculture and Rural Development
NPF	National Plan Fako
LWM	Local White Maize
S-M-C-R	Sender-Message-Channels-Receiver
SPSS	Statistical Product and Service Solutions
UNICEF	United Nations Children Fund
WAKM	Wood Ash and Kerosene Mixture

CHAPTER ONE

INTRODUCTION

Background to the study

The concept of development has existed for centuries because the ultimate aim of countries, states, nations, communities and world organisations from their time of existence, has been to improve the living conditions of people. However, development has gained currency due to the growing concern of governments, some world institutions and civil society organisations to curtail the exacerbating rate of poverty. The percentage of Africans living on less than US$1 a day for example, increased from 41.6% in 1981 to 46.4% in 2001 (World Bank, 2005).

Countries have adopted different approaches to develop, which have also varied with the passage of time. In the 14th century for example, the British transported slaves from Africa to Britain to build infrastructure, produce goods and render menial services. In the 17th century, Britain shifted to the industrial revolution, whereby work done with the hands was replaced by machines. The rationale behind the revolution was to increase the production of goods and services to meet the demand of consumers. Another approach that was used simultaneously by Britain and America in the 17th and 18th centuries to propel development was capitalism. For this approach, a group of people owned and controlled the means of production to enrich

themselves and develop their countries at the expense of others (Webster, 1990). In the 18th century, Britain also established colonies in Africa and Asia to extract raw materials to be manufactured into finished goods that were in turn sold in the colonies. France, Germany and Belgium also established colonies in Africa for economic reasons (Rist, 2002).

Developing countries such as China and Tanzania used a socialist approach to develop. In 1949, China under the leadership of Mao Tse-tung, gave room for state intervention and developed its industrial sector to equip its peasant farmers with skills to increase production. In 1961, Tanzania under the leadership of Julius Nyerere, rejected state collectivism and industrialisation and rather empowered the peasant farmers by placing the control of the country's agricultural resources in their hands, through the establishment of village co-operatives and familyhood village schemes (Webster, 1990).

As the years unfolded, many developing countries realised that their previous approaches to enhance the living conditions of people yielded little or no fruits, since poverty rather increased. This prompted them to adopt new paradigms. Presently, a good number of developing and developed countries are using a neoliberal approach to curtail poverty. This paradigm shift is based on foreign direct investment, free trade and aid. Governments in developing and developed countries believe that in adopting this shift, foreign capital will be attracted, employment shall be generated, competition in the local markets will be spurred and development programmes shall be financed (Meier & Stiglitz, 2000).

Local participation is another approach being used by many governments and institutions in developing countries to bring on board the

development initiatives of the local people. By so doing, the local people are involved in most stages of the decision making process to ensure the success of development interventions in their communities (Burkey, 1993). Decentralisation is a current paradigm used by many developing countries in their development efforts. Sub national governments are established at the local level to enable local people to influence public affairs, in at least, some modest ways that will give them a new sense of control and autonomy (Smoke, 2003).

The livelihood approach is the most recent approach that has been adopted by most Sub-Saharan African countries to improve the socio-economic conditions of its people in the rural and urban areas. The approach is explained by the sustainable livelihood framework which comprises five concepts that present an integrated outlook of livelihood. These concepts are the vulnerability context, livelihood assets, structures and processes, livelihood strategies and livelihood outcomes (DFID, 1999). People engage in several occupations such as fishing, hunting, trading and farming to derive a source of livelihood.

Farming, in its varied forms, serves as a source of livelihood outcomes. These forms include cash crop, food crop and livestock farming. Technology is used to cultivate crops and rear livestock. In farming, technology is aimed at enabling farmers to acquire and apply knowledge on how to cultivate their crops and rear livestock (Princeton, 2008). However, there are certain factors that will predispose farmers to take interest in technology. Byrness and Byrness (1978) argue that the educational level of farmers, to some extent, determines their level of participation, type of tasks and farming technologies that they may adopt. The International Centre for Maize and Wheat

Improvement- CIMMYT (1993) postulate that older farmers have more experiences, resources or authority for trying a new technology, while younger farmers are likely to adopt a new technology, because they are more educated and cosmopolitan than the older generation. Gamble and Gamble (2002) argue that the sex of farmers may incite differences in gender perceptions between males and females that will in turn affect their interest in farming technologies.

Van De Ban and Hawkins (1988) maintain that extension officers have a crucial role to play in enabling farmers to take interest in technology, by helping them to adopt and diffuse it to other farmers. The modernisation theorists opine that farmers who are conservatives are more likely to reject a new technology and rather adhere to an old technology, while farmers who are open-minded are more willing to adopt new technologies (Webster, 1990). Adato and Meinzen-Dick (2002) posit that farmers' access to capitals and support from institutional settings can also predispose them to adopt new technologies. Reijintjes, Balasumbramanian and Devi (2006) canvass that farmers will preferably use traditional practices derived from their indigenous knowledge to cultivate their crops, because they are more affordable and easily understood by them.

The inhabitants in the rural and semi rural areas of Cameroon are engaged in farming, as one of the means to derive a source of living. The inhabitants are also engaged in other activities such as hunting, fishing and petty-trading to make a living. Traditional and improved technologies are used by the inhabitants to cultivate cash crops, food crops and fruits. The traditional technologies are organic manure, local seedlings, wood ash and kerosene mixture, while the improved technologies are the use of inorganic fertilizers, improved seedlings, insecticides and herbicides. The types of cash crops that

are grown include cocoa, coffee, cotton, palm nuts, rubber, timber and tea. The food crops that are grown include maize, yam, cocoyam, cassava, plantain, potatoes and vegetables. The fruits that are grown include pineapple, orange, grape, pawpaw, watermelon, apple and sugar cane. However, of all the food crops, maize is one of the most important. It is cultivated on about 600,000 ha for a total annual grain production of 800,000 metric tons (Ngoko, Cardwell, Schulthess, Marasas, Rheeder, Shepherd & Wingfield, 1997). There are several maize varieties that are produced in Cameroon. These include the local white and yellow types of maize, and improved varieties such as CMS 8501 (improved white maize), CMS 8704 (improved yellow maize), SHABA, BSR81 and COCA-SR (Elang, 2006).

The Buea sub-division is an example of a semi rural area in Cameroon that cultivates maize. In this sub-division, there exist two groups of farmers; those who use traditional and those who use improved farming technologies to cultivate maize for their livelihoods. They also rear livestock to supplement their incomes. People in other occupations such as teaching, administration, hunting and petty trading are also engaged in maize farming. Of all the food crops that are grown in the sub-division, maize is one of the most important food staples. It is used to prepare pudding, porridge and fufu. Only three of the maize varieties common in the country are grown in the Buea sub-division. These are the local white maize, improved white maize (CMS 8501) and improved yellow maize (CMS 8704). These varieties are grown twice a year and embody different technologies that are aimed at increasing yields and incomes for improved livelihoods.

Statement of the problem

Research has shown that 60% of the maize produced in Cameroon for domestic consumption and export comes from the Buea sub-division (Buea Sub-Divisional Delegation for Agriculture and Rural Development-BSDDARD, 2006). Due to the economic importance of maize, most farmers in the sub-division rely on it for their livelihoods. There exist two groups of maize farmers in the sub-division; farmers who use: traditional technologies and those who use improved maize technologies. The farmers (65%) who use traditional maize technologies, have complained of experiencing lower yields and incomes for three consecutive years (2006 to 2008) compared to their counterparts (35%) who use improved maize technologies. They have also complained of experiencing negative livelihoods, as a result of their low yields and incomes. They have also complained of having limited access to the services of extension officers, who are to assist them to adopt and diffuse maize technologies (BSDDARD, 2006; 2007; 2008).

In spite of their complaints, these farmers continue to use the traditional technologies which appear not to be helpful to them. Several questions can be raised about the motivations for their continued use of the traditional technologies. It is not known whether the reasons are attitudinal, financial or technical. In the view of Ban and Hawkins (1988), persuasion of farmers on the positive impact of an innovation on their livelihoods will provide an opportunity for the decision to adopt the innovation. Whichever way one looks at the situation, the need to investigate the perceptions of these farmers regarding the impact of the use of the various maize technologies on their livelihoods become evident. The phenomenon provokes investigation

that will yield answers to the following questions:

1. What are the effects of maize technologies (traditional and improved) on the yields, incomes and livelihoods of farmers?
2. Which of the maize technologies are appropriate to enable farmers attain better yields, incomes and livelihoods?
3. Who are those to guide or assist farmers in applying the appropriate maize technology for the betterment of their yields, incomes and livelihoods?

Objectives of the study

The general objective of the study was to examine farmers' perceptions of the contribution of maize farming technologies to livelihoods in the Buea sub- division of Cameroon.

The specific objectives of the study were to:

1. Examine the association between farmers' demographic characteristics and the use of maize technologies.
2. Examine farmers' views of other factors that influence their usage of maize technologies.
3. Compare the yields and incomes of farmers' who use traditional technologies to their counterparts who use improved maize technologies.
4. Examine the perceptions of livelihoods of the different groups of farmers.
5. Discuss the role played by extension officers in enabling farmers to adopt and diffuse maize technologies.
6. Make recommendations for farmers and extension officers on the appropriate technologies to use in cultivating maize and techniques to use

in training farmers to adopt and diffuse maize technologies.

Research questions

The research questions of the study were:

1. What association exists between farmers' demographic characteristics and their use of maize technologies?
2. What are farmers' views of other factors that influence their usage of maize technologies?
3. How different are the yields and incomes of farmers who use traditional technologies from that of farmers who use improved maize technologies?
4. What are the livelihood perceptions of the different groups of farmers?
5. What roles do extension officers play in enabling farmers to adopt and diffuse maize technologies?

Hypotheses

The following hypotheses were formulated to guide the study:

1. H_o: There is no significant association between the demographic characteristics of farmers and their use of maize technologies.

   H_1: A significant association exists between the demographic characteristics of farmers and their use of maize technologies.
2. H_o: There is no significant difference between the yields and incomes of farmers who use traditional technologies and those who use improved technologies.

   H_1: There is a significant difference between the yields and incomes of farmers who use traditional technologies and those who use improved

technologies.

Scope of the study

The study sought to examine the perceived contribution of maize technologies, specifically maize varieties and inputs, to farmers' yields, incomes and perceptions of their livelihoods from 2006 to 2008.

Significance of the study

The successful completion of this study will enable agricultural policy makers in the Buea sub-division to ascertain the appropriate maize technologies that will be favourably adopted by farmers to improve their yields. The study will also identify some of the motivating factors that influence farmers' use of maize technologies. This will guide extension agencies to develop appropriate persuasion strategies for improving the adoption rate of various agricultural technologies, and more farmers will gain access to and adopt these technologies to improve their incomes and livelihoods. The study will assist extension officers to enhance their competencies in training farmers to adopt maize technologies. It will also provide useful information for policy makers, development practitioners, researchers and non-governmental organisations in the country, on maize farming in the Buea sub-division.

Organisation of the study

The study was organised into five main chapters. Chapter One provided an introduction of the study. It examined the background to the study, the statement of the problem, objectives of the study, the research

questions, hypotheses, scope, significance and organisation of the study. Chapter Two provided a review of related literature on the theories, empirical evidence and concepts underlying the study. Chapter Three discussed the methodology of the study. It captured a description of the study area, research design, study population, sample size, sampling procedures, instruments for data collection, pre test, field challenges and the methods for data analysis. Chapter Four presented the results and discussions from the analyses of data. Chapter Five presented the summary, conclusions and recommendations.

CHAPTER TWO

REVIEW OF LITERATURE

Introduction

The review of literature brings together the theoretical and conceptual issues, as well as the empirical studies that provide the background and necessary basis for the study. It attempts to review related works on the theories of development, the modernisation theory, adoption theory, sender-message-channels-receiver (S-M-C-R) theoretical communication model, Schramm's interactive model, diffusion theory and the perception theory. These theories provide explanations as to why farmers will take interest in particular technologies, how they can perceive issues and how extension officers can enable farmers to adopt and diffuse farming technologies.

The review also provides related works on indigenous knowledge that can influence farmers' use of traditional technologies and the demographic characteristics of farmers that influence their use of technology. Literature on the livelihood framework is also reviewed, to provide an in depth understanding of livelihood. Empirical literature of how maize technologies have been applied and the effects it has had on the yields and incomes of farmers in other countries is reviewed. Lessons learnt from the literature are also provided. The review of literature, finally builds a conceptual framework

that provides a linkage of the main concepts of the study.

Theories of development

Several theorists have advanced different expositions about development. The classical, neoclassical and keynesian economic theorists for example, viewed development from an economic perspective. The classical economic theorists propounded that countries should manufacture goods and engage in technical innovations in agriculture to attain economic growth. This will expand their national output, increase labour productivity and create opportunities for an increase in the division of labour. They maintained that when countries engage in technical innovations in agriculture, they can curb growing food shortages and misery, which may arise from an increase in birth rates and eventually cause population growth (Hunt, 1989).

The Keynesian theorists canvassed that economic growth can be attained, when an increase in demand creates supply and hence employment. However, the capacity for consumers to demand will be influenced by their income levels. They added that the more a country saves, the more it can invest to increase its output that will in turn stimulate economic growth (Hunt, 1989).

The neo classical economic theorists opined that economic growth could be attained, when consumers derive marginal utility from the exchange of a particular commodity for another commodity, via trade with other countries. They added that marginal utility can also be derived, when the factors of production are rewarded. For instance, an individual will derive marginal utility from labour, capital and entrepreneurship, if he or she receives wages, interest and profits respectively (Peet & Hartwick, 1999).

Unlike the economic theorists, Burkey (1993) conceived development from a human and social perspective. Development should seek to meet the basic needs of poor people, which are food, shelter, clothing, safe drinking water, sanitation, public transport, health and educational facilities. From a political perspective, development should seek to ensure that the political structure of a country is responsive to the people's needs and aspirations, as well as protect their rights and property. Development should also seek to increase people's awareness of their capabilities, rights, responsibilities and use this knowledge, to organise themselves to acquire real political power. This will enable them to choose leaders who will represent them at higher levels of government and be accountable to them. It will also enable them to participate in decision making at the local level; plan and share power democratically; create and allocate communal resources equitably and efficiently among individual groups (Burkey, 1993).

The ecodevelopment theorists had an environmental viewpoint about development. They opined that development should make efficient use of the natural and human resources of a specific region, in such a way that it can provide for the minimum basic needs of people living there, while at the same time maintaining a viable ecological environment (Burkey, 1993). The endogenous development theorists had a cultural perspective about development. They argued that countries should rather promote their local knowledge and technologies, local institutions, indigenous culture, leadership and resources to enable them to develop. However, countries could also allow the integration of outside knowledge and practices to complement their local development efforts (Haverkort & Rist, 2007). Holistically, development can therefore be defined as an enhancement of the economic, social, political, environmental and cultural conditions of people.

Modernisation theory

In the 1950s and 1960s, a number of social scientists challenged indigenous knowledge, arguing that it rather enslaved and underdeveloped people particularly in developing countries. These social scientists were called the modernisation theorists (Ayres, 1995). The modernisation theory was developed by a number of social scientists who were divided into three groups: the sociological, economic and psycho-cultural modernisation theorists (Peet & Hartwick, 1999).

The sociological modernisation theorists held that a society was modernised, when it is able to specialise in different functions, disintegrate from traditional elements and embrace qualitative characteristics of modern societies such as rationality, efficiency and liberty. The economic modernisation theorists examined the differences in the behaviours of peoples in modern and traditional societies from an economic standpoint. In terms of the distribution of economic roles, they argued that people in the traditional society had particularistic norms, relied on ascription, are typically diffused and self oriented. In the modern society, people had universalistic norms, relied on individual achievement, specialised in particular functions and were collectively oriented. The psycho-cultural modernisation theorists harped on the psychological, cultural and behavioural dimensions of technological change (Peet & Hartwick, 1999).

With regard to the psycho-cultural dimensions of modernisation, Webster (1990) postulated that people in traditional societies have the perception that an uncontrollable force is dominating their lives; fearing the

world and its problems, traditional people became uncreative and authoritarian. However, the authoritarian personality can be changed, if groups of people experienced domestic or external conquest or migration and searched for a satisfactory new identity through withdrawal and social deviancy. As retreat deepened through successive generations, the circumstances of home life and social environment eventually became conducive to the development of an innovative personality. Under such circumstances, creative individuals see technological prowess as a path to the satisfaction of their needs. The values of these individuals might then turn in the direction of innovations in production, institutional reform and economic growth. This deviant group will then lead the society towards modernisation (Webster, 1990).

Adoption theory

In most developing countries, very few agricultural extension agents are assigned to a large number of farmers. The Food and Agricultural Organisation (1990) estimates that the number of economically active farmers in developing countries who receive extension services each year is one in five (20%). In spite of the constraints, extension agents play an instrumental role in enabling farmers to adopt maize technologies or innovations.

Adopting a new farming technology is a process that has to be undertaken gradually to bring about desirable change. Van de Ban and Hawkins (1988) argued that for an innovation to take place within a society, it must be adopted. An innovation is an idea, method or object which is regarded as new by an individual, but which is not always the result of recent

research. Van de Ban and Hawkins (1988), Moris (1991), Swanson, Bentz and Sofranko (1997) proposed six stages of the adoption process in farming which are: knowledge, persuasion, evaluation, trial, decision and implementation or adoption. These stages are embedded in the adoption theory.

Knowledge refers to getting information and learning about the techniques of an innovation before adopting it. Knowledge of an innovation is critical to people. In this regard, the mass media and popular theatre are the preferred methods, because they can reach many people at the same time. However, in using the mass media, extensionists must pay attention to the characteristics of the audience targeted. For instance, an ethnic group with a special language may require programming in that language. Popular theatre is also a very effective means of building awareness, because it uses the popular language and rhythms of the people in presenting the content to the audience (Moris, 1991).

Persuasion refers to a change of attitude after learning about an innovation. It also involves weighing many options, before considering whether or not to adopt an innovation. However, persuasion can occur after the decision to adopt, which is sometimes taken without careful consideration of the possible consequences. Building a positive attitude towards an innovation is also critical. It is therefore incumbent for extensionists to include desired methods such as information strengthening and attitude building as their goal. These methods should use the senses of hearing and sight, either individually or collectively. In this case, group meetings, discussions and radio forums should be used to strengthen knowledge. Field days and farm visits should also be carried out to allow individuals to see what they have been

hearing. This will provide the opportunity to build the desired attitude towards an innovation (Van de Ban & Hawkins, 1988).

Evaluation is the most critical stage in the adoption process, because the outcome usually determines whether or not individuals should proceed to the trial and adoption stages. At this stage, farmers need to be assured that what they heard and saw are indeed workable. This can be done through farmers' exchange. Farmers who are already further advanced in the adoption process can be selected for the exchange and should be within the same reference group as the visiting farmers. These types of experiences allow for the removal of doubts. Some skill training may also be necessary at this stage, to facilitate the farmer's progression to the trial stage (Swanson et al., 1997).

At the trial stage, the farmer's technical and management skills are targeted. Farm visits becomes the most preferred method at this stage and the needs of individual farmers must be taken into consideration. This means that the extension officer will have to develop a plan for each individual farmer or group of farmers in similar situations. However, the extensionists must remember that although farmers may be adopting similar techniques, the problems experienced by each farmer may be different. The methods that were used at the evaluation stage (farmer exchange and skill training) to reinforce the farmers' interest can be employed to continue the adoption process (Moris, 1991).

Depending on the results obtained from the trial stage, a farmer may either accept or reject an innovation. This is known as the decision stage. When a farmer accepts an innovation, he or she will fully implement it. This is known as the implementation stage. At this stage, the innovation is modified to suit more closely the needs of the farmer who adopts it. Implementation can

however, be partly undertaken before the decision is taken. Once farmers start adopting an innovation, extension officers should continue to support their efforts. Recognition programmes and farmers competition can be used to encourage farmers to continue adoption. The goals and criteria for these methods should however, be carefully developed in order not to bring about any negative effects because of poor planning and implementation (Swanson et al., 1997).

Sender-message-channels-receiver communication model

In the S-M-C-R communication model, Berlo (1960) noted that adopting an innovation depends on how well the sender communicates with his or her audience and how the audience in turn reacts to the message communicated by the sender. If a message is properly communicated by the sender, then the receiver or audience will react positively. On the contrary, if a message is not properly communicated by the sender through the use of unfamiliar words or styles, then the receiver will react negatively. The Food and Agriculture Organisation-FAO (1999) maintained that communication consists of four aspects which are: the sender, message, channels and the receiver, as depicted by Berlo's model of communication.

The sender, who is the source of information, expresses his or her thought through the human senses, mostly sight and sound. The sender encodes and sends messages based on past experiences. The message is the idea or concept and how it is presented by the sender. Channels are related to the human senses (sight, sound, touch, taste and smell) of the receiver, who acquires the message and interprets it based on past experiences.

However, there are three problems encountered by the senders in

communicating with their audience. These problems are encoding deficiency, gatekeepers and interference. Encoding deficiency relates mostly to the sender's lack of communication skills and knowledge of the audience. This might involve using unfamiliar words or terms. Gatekeepers are the people who control the media or other access to communication channels. They can either distort or block the message. Interference is often a more physical problem in reaching a target audience. This can pre-empt information from being understood by or getting to the target audience (Etling, 1995).

Schramm's interactive model

Unlike Berlo's communication model, which is linear, Schramm's interactive model addresses feedbacks in communication. The type of orientation or attitudes which interactants maintain towards each other is what Schramm (1954) referred to as feedback. Going by the author, communication is reciprocal, two-way, even though the feedback may be delayed. Some of these methods of communication are very direct, while others are moderately direct and completely indirect.

Mysak (1970) added that during communication, a message may have different meanings, depending upon the specific context or setting. A message may also have different meanings associated with it depending upon the culture or society. Thus, communication systems operate within the confines of cultural rules and expectations.

Diffusion theory

Once an innovation is communicated to and adopted by a farmer or

group of farmers and has proved workable, it will later on be adopted by other farmers. This process is known as diffusion. In some countries, farmers are keen observers of how other farmers work. This is because they spend much time discussing their farm experiences with their friends and neighbours and learn much in this way. Although most realise that they learn more from some colleagues than others, they know who gets good yields or good results in their village and who experiments with new methods. Some of these successful or progressive farmers are willing to share their experiences with other farmers. In this way, they become opinion leaders in the village, because they help other farmers to solve problems that they consider to be important (Van de Ban & Hawkins, 1988).

Farming technologies that offer significant improvement in economic returns will spread quickly among farmers based on the example: “the best extension agent is looking over your neighbour’s fence.” However, the extension process can play a significant role in spreading technology that gives high returns more rapidly to farmers with fewer resources and smaller holdings. The process can also help in spreading improved technology that offers less dramatic returns among a wide range of farmers (FAO, 1989).

A farmer becomes an opinion leader when he or she is able to fulfil several functions in his or her group with regard to innovations. These functions include transmitting information from outside the group; interpreting information from outside on the basis of his or her own opinions and experience; setting an example for others to follow; legitimising or rejecting changes that others want to carry out and influencing a change in group norms. A farmer discusses frequently with other farmers who are similar to him or her

in social status, farm size, education, age. However, because they are so similar in many aspects, it is likely that other farmers will have as much information as they have. Opinion leaders of such groups, must therefore be sufficiently different to be able to provide new information and discuss its relevance to other farmers (Rogers, 1983).

An opinion leader in a group made up of farmers with similar status must be able to distinguish himself or herself from other members. The leader can do this by adopting many innovations; ensuring that he or she is well educated and enjoys sound financial positions in his or her community; living an active social life; having contacts outside his or her immediate surroundings and developing special interest in his or her subject. However, interaction between members of different social strata can be limited in communities with a rigid social stratification. Each of these strata can have its own opinion leaders, who have only a limited influence among other strata. This is the case for instance, among large landowners and peasants in Latin America. In such situations, extension agents try to establish contacts with opinion leaders from each of the groups, in order to influence a large proportion of the farmers (Swanson et al., 1997).

An extension agent can identify an opinion leader by carefully observing the social processes in the community. The extension agent may observe how people will react according to who is speaking in a meeting or an informal discussion. The extension agent could also seek assistance from some villagers or outsiders who know the community well. For example in the village council, the extension agent can point out that a demonstration will be more effective, if it is held on an opinion leader's farm and then seek

suggestions about where it can be held. However, the danger with this approach is that his or her advisor might mention only people from his or her faction, if there are conflicts in the community. It is therefore imperative for extension agents to make a list of all local farmers and ask his or her advisors to judge each farmer, according to the influence he or she has in discussions about farming (Van de Ban & Hawkins, 1988).

Extension agents must also bear in mind that it is more difficult working in communities where most farmers are not yet interested in adopting innovations. In this situation, the extension agents should try to gain the trust of opinion leaders and develop their interest in modernising agriculture, so that they can in turn influence other farmers. The extension agents should also be aware that there may be conflicts between different religious, tribal or status groups in the community. For example, small and poor farmers may be convinced that the large and high status farmers are trying to exploit them. Thus, the extension agent may lose the trust of one faction by cooperating with another. In such situations, the agent should try to cooperate with all the factions where there are serious conflicts (Rogers, 1983).

Perception theory

Perception has been defined by many scholars in different ways. Van de Ban and Hawkins (1988) defined perception as the process by which information is received from the environment and transformed into psychological awareness. Perception is a process of selecting, organising, subjectively interpreting sensory data, in a way that enables us to make sense of the world. Therefore, perception involves the use of the senses to interpret

the world or environment. However, perception involves more than the use of the senses alone. Perception is epitomised as the "I" behind the senses. By implication, what occurs in the real world may be quite "poles apart" from what is perceived to occur. In other words, the interpretation of events may differ markedly from the actual events among different people (Gamble & Gamble, 2002).

Perceptions are relative rather than absolute. For instance, when a person enters a darkened room during the screening of a film, he will see only the image on the screen and the bright light from the projector. After a minute or so, he will be able to see other people in the room. In other words, his or her initial perception of darkness in the room is relative to the amount of light outside. Perceptions are also organised. The sensory experiences are structured in ways that will be sensible to human beings. One form of organisation is the figure and ground. The interpretation of the figure will often be determined by the ground. For example, a picture of a man with a dirty face, hands and old clothes can be interpreted as a lazy or poor person. The picture can also be interpreted as one of a hard-working farmer, if a farmyard is included in the background (Barbe, 1981).

Perceptions are very selective. At any moment, human senses are receiving a veritable flood of stimuli from the environment. Objects can be seen, noises can be heard and odours can be smelt. Despite their capacity to process vast amounts of information, the nervous system cannot make sense of all the stimuli available. Hence an individual pays attention only to a selection of stimuli. Several physical and psychological factors influence what an individual selects or pays attention to. Individuals select only those

experiences that reaffirm existing attitudes, beliefs and values. They ignore or diminish the significance of those experiences that are inconsistent with their existing attitudes, beliefs and values. Past experiences and training influences the selectivity of perceptions. Training can also provide an organised and structured set of experiences to influence perceptions (Moris, 1991).

An individual's perceptions will also differ markedly from another's in the same situation because of different cognitive styles. Individual mental processes work in distinctly different ways, depending on personality factors such as tolerance for ambiguity, degree of open and closed mindedness and authoritarianism. However, it is impractical to design different messages to take into account all combinations of cognitive styles among audiences. A strategy can therefore be adopted, to present the same idea in a number of different ways that will appeal to peoples cognitive styles. This is known as message redundancy (Barbe, 1981).

Perceptions are directed. For instance, a writer of an extension bulletin who starts with a brief summary of his or her article will set the reader to seek the key points in it. A caption or a heading in a slide presentation sets the viewer to observe those key points. However, perceptual set may be a major deterrent, when the communicator wants his or her audience to view or interpret a situation in a particular way. The tendency is to respond to stimuli through habit and these habitual responses are broken, if things are perceived in a new way. However, perceptual set can be affected by age, motivation, past experience and educational level. Age alone does not determine the part played by experience. Even among people of the same age, past experiences differ and hence affect the way stimuli are perceived. In the case of education,

it can sometimes become a barrier rather than a facilitator or aid to communication (Gamble & Gamble, 2002).

Indigenous knowledge

Indigenous knowledge is the actual knowledge of a given population that reflects their experiences based on tradition and includes more recent experiences with modern technologies (Reijintjes, Balasumbiamanian & Devi, 2006). Indigenous knowledge is also local knowledge held by indigenous peoples or local knowledge that is unique to a given culture, which is different from western knowledge systems designed scientifically to lock out feedback from the environment and avoid natural perturbation (Millar & Abazaam, 2008).

The marginalised, rural, traditional and indigenous people in many countries esteem their traditional practices and local knowledge, because they cannot afford the costs of modern inputs, medicines and consumer goods. In the vision of farmers, revitalising traditional culture and agriculture may solve present problems to a large extent. This is because local farmers will find it easier to understand and afford local farming technologies, than they would for modern technologies. However, from the viewpoint of the market economists, such people have become or are still economically unviable and therefore cannot benefit much from modern development. Their chances in the market can only be improved to a limited extent by way of modern technology, improved marketing and good governance (Reijintjes et al., 2006).

Demographic characteristics that influence farmers' usage of technology

The personal characteristics of an individual play a major role in all

behavioural patterns of that individual. It is therefore estimated that the demographic characteristics of farmers in terms of their sex, age and educational level can contribute to their adoption behaviours.

The sex of farmers can influence adoption. For example, males and females have been found to differ in their responses to different innovations. Accordingly, Nelson (1981) opined that in designing farming technologies, it is wrong to assume that technologies used by males will equally be appropriate for women's use. This is because in farming, men and women have different needs and desires.

Overholt, Anderson, Cloud and Austin (1984) argued that in the agricultural sector in all developing countries and most industrialised countries, men monopolise the use of more efficient types of equipment operated by animal or mechanical power, while women perform simple manual tasks. Often, men apply modern scientific methods to cultivate cash crops, while wives continue to cultivate food crops by traditional methods. Feldstein and Poats (1997) maintained that in farming, men and women have different needs and desires and therefore admonished that appropriate technologies should be developed and included for women in extension programmes.

Campbell and Barker (1997) added that recognition must also be given to the particular functions such as planting, replanting, weeding, seed selection and storage, that women perform within the farming system and their work schedule in the household environment. With regards to the attributes and character traits of men and women that influence their use of technology, Gamble and Gamble (2002) canvassed that men and women perceive different

realities, have different expectations set for them and while women are categorized as emotional, men are classified as rational.

The age of farmers has been identified as another demographic characteristic of farmers that contribute to their adoption behaviours. CIMMYT (1993) noted that older farmers have more experiences, resources or authority for trying a new technology, while younger farmers are likely to adopt a new technology, because they are more educated and cosmopolitan than the older generation. This means that some technologies would have greater appeal to older and more experienced farmers, while others would be more attractive to the younger farmers.

Swanson et al. (1997) maintained that generally in most developing countries, a significant proportion of the agricultural activities take place in the rural areas, where 20 to 80 percent of the population may live. Agriculture equally has a low status, because of the low level of technology it employs and low income-earning capacity. This has caused vast migration of young people from the rural to the urban areas. As a result, more old people are engaged in agriculture in the rural areas.

Campbell and Barker (1997) therefore cautioned that extension should therefore consider age as an important characteristic for targeting not only the youth, but also, other age categories. Extension programmes should also aim at increasing the level of technology used and income earning capacity. If this can be done, then there is a good chance that the young people will remain in the rural areas.

The influence of formal education on technology adoption is not a straightforward issue. According to Byrness and Byrness (1978), education

enhances one's ability to receive, decode, understand, process and interpret information, which are important for performing many jobs. The authors added that a farmer's level of education to some extent, determines the types of tasks he or she is capable of undertaking in any programme and therefore his or her level of participation. Farmers with low education therefore, require greater extension efforts to attract them to participate in innovative programmes and help them accept and use improved technologies. Aryeetey (2004) espoused the arguments of Byrness and Bryness by canvassing that the educational level of farmers to a greater extent influences the types of technologies that they may chose or adopt in an agricultural programme.

Röling (1990) declared that the quality of innovativeness in farming is clearly related to the level of formal education of the farmer and the competency of the agricultural extension workers. Chung (1991) noted that the literacy level among farmers is highly correlated with the utilisation of modern technology. In effect, communities whose farming population is better educated are more likely to adopt and use innovative technologies for agricultural production. However, Gamble and Gamble (2002) countered that the high level of education can sometimes became a barrier, rather than a facilitator or aid to communication.

It is sometimes realised that people with lower levels of formal education are able to carry out some agricultural activities and practices more efficiently and effectively than people with higher education. Leonard (1977) found in Kenya that farming technologies that are quite simple and do not involve complicated activities are easily adopted by farmers with low literacy levels. Agricultural extension agents who have only attained the upper primary

education have a clear tendency to know more and to explain better than those with either secondary education or only lower primary schooling. This curvilinear tendency is evident in all technical areas of agricultural extension. However, the more complicated a skill is, the higher the educational level at which the best performance can be achieved. This implies that, although it is possible for agricultural science teachers in Junior Secondary Schools to adequately influence the dissemination of simple farming technologies in the farming communities, the more complicated problems would require the attention of agricultural experts with the members of the community.

Livelihood framework

Livelihood comprises the capabilities, assets and activities required as a means to a living. It is considered sustainable, if it can cope with and recover from stress and shocks; maintain or enhance its capabilities and assets; provide net benefits to other livelihoods locally and more widely, both now and in the future without undermining the natural resource base (Carswell, 1997).

Livelihood is also a wide range of activities that make up people's lives. These activities include gaining and retaining access to resources and opportunities; dealing with risk and negotiating social relationships within the household; managing social networks and institutions within communities and engaging in income generating activities (Odabode, 2004)). An individual, household or social group, may be enabled to gain sustainable livelihood security through ownership of land, livestock or trees; right to grazing, fishing, hunting or gathering and stable employment with adequate remuneration (Bohle, 2007).

Livelihood tackles poverty not only from the income approach, but also from the socioeconomic dimensions within households and communities. The livelihood approach examines the institutional settings that underpin these dimensions to give rise to favourable livelihood outcomes. In this regard, the approach assumes that people draw on a range of assets to pursue livelihood activities that will result in favourable livelihood outcomes. The approach comprises five concepts that build and positively or negatively affect livelihood. These concepts are vulnerability context, livelihood assets, structures and processes, livelihood strategies and livelihood outcomes (Adato & Meinzen-Dick, 2002).

Vulnerability context refers to things that are outside people's control. It is usually negative, but it can also provide positive opportunities (Department for International Development- (DFID), 1999). Adato and Meinzen-Dick (2002) stated that the vulnerability context encompasses:

- Trends in population, resources and economic indicators such as prices, governance, technology;
- Shock*s* such as changes in human and animal health, natural disasters, sudden economic changes or conflict;
- Seasonality in prices, agricultural production, employment opportunities, resource availability or health.

Livelihood assets are resources that people use to build livelihood and are sources of capability to act, engage in and change the world (Odabode, 2004). DFID (1999), De Haan (2000), Adato and Meinzen-Dick (2002) and Odabode (2004) added that livelihood assets comprise five types of capitals which are: human, natural, financial, physical and social capitals.

Human capital represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives. Human capital (knowledge and labour or the ability to command labour) is required in order to make use of any of the four other types of assets. It is therefore a necessary input for the achievement of positive livelihood outcomes. Support to the accumulation of human capital can be both direct and indirect. In either case, it will only achieve its aim if people themselves are willing and able to invest in their own human capital by attending training sessions or schools, accessing medical services (DFID, 1999).

Natural capital is the term used for the natural resource stocks from which resources flows and services (nutrient cycling, erosion protection) useful for livelihoods are derived. It comprises intangible public goods such as the atmosphere and biodiversity to divisible assets used directly for production (trees, land). It consists of land, water and biological resources such as trees, pasture and wildlife (De Haan, 2000).

Access to land in particular, depends on it cost. When the cost of land is moderate, people tend to have more access to it and when the cost is astronomical, people tend to have limited access to it. Natural capital is very important to those who derive all or part of their livelihoods from resource-based activities (farming, fishing, gathering in forests, mineral extraction). The livelihood approach tries to take a broader view to focus on people and to understand the importance of structures and processes (land allocation systems), in determining the way in which natural capital is used and the value that it creates (De Haan, 2000).

Social capital is the social resources upon which people draw in pursuit of their livelihood objectives. It is any asset such as rights or claims that are derived from membership of a group. This includes the ability to call on friends or kin for help in times of need, support from trade or professional associations (farmers' association) and political claims on chiefs or politicians to provide assistance. Social capital can be developed through networks and connectedness; membership of more formalised groups; relationship of trust, reciprocity and exchanges. Networks and connectedness are either vertical (patron/client) or horizontal (between individuals with shared interests) that increase people's trust and ability to work together and expand their access to wider institutions such as political or civic bodies (De Haan, 2000).

Membership of more formalised groups entails adherence to mutually agreed or commonly accepted rules, norms and sanctions. Relationships of trusts, reciprocity and exchanges facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor. Membership of groups and associations can extend people's access to and influence over other institutions. Likewise trust is likely to develop between people who are connected through kinship relations or otherwise (De Haan, 2000).

Of all the capitals, social capital is the most intimately connected to transforming structures and processes. It can be useful to think of social capital as a product of these structures and processes, though this over simplifies the relationship. Structures and processes might themselves be products of social capital. The relationship goes two ways and can be self-reinforcing. For example, when people are already linked through common

norms and sanctions, they may be more likely to form new organisations to pursue their interests. Strong civil society groups also help people to shape policies and ensure that their interests are reflected in legislation. Social capital has a direct impact on other types of capital. It can for example, help increase people's incomes and rates of saving (financial capital). It can also improve the management of common resources (natural capital), maintain shared infrastructure (physical capital) and also facilitate the development and sharing of knowledge (Adato & Meinzen-Dick, 2002).

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. It consists of stocks of money or other savings in liquid form. In this sense it includes, not only financial assets such as pension rights, but also easily-disposed assets such as livestock, which in other senses may be considered as natural capital. The indicators are financial savings and access to credit (Adato & Meinzen-Dick, 2002).

There are two main sources of financial capital (available stocks and regular inflows of money). Available stocks are savings which are the preferred type of financial capital, because they do not have liabilities attached and usually do not entail reliance on others. They can be held in several forms: cash, bank deposits or liquid assets such as livestock and jewellery. Financial resources can also be obtained through credit providing institutions. Regular inflows of money are earned income, pensions or other transfers from the state and remittances. In order to make a positive contribution to financial capital, these inflows must be reliable (Adato & Meinzen-Dick, 2002).

Access to financial capital is supported through indirect means, which are organisational, institutional and legislative/regulatory. Organisational

support comes by way of increasing the productivity of existing savings and financial flows, through the development of effective financial services for the poor. So long as the financial services are well-trusted, accessible and widely known, they may encourage people to save. Institutional support comes by increasing access to financial services, such as removing barriers associated with poor people's lack of collateral. This may be done either by providing some sort of umbrella guarantee or by identifying mechanisms that enable people's existing assets to act as collateral. Legislative/ regulatory support is provided through the reforms of the environment in which financial services operate or by helping governments to provide better safety nets for the poor, including pensions (DFID, 1999).

Physical capital is that created by economic production. It comprises the basic infrastructure and producer goods needed to support livelihoods. Infrastructure consists of changes to the physical environment that help people to meet their basic needs and to be more productive. Producer goods are the tools and equipments that people use to function more productively. The components of infrastructure and producer goods include roads, ownership or access to productive equipments (Odabode, 2004).

The opportunity costs associated with poor infrastructure can preclude education, access to health services and income generation. For example without transport infrastructure, essential fertilizer cannot be distributed effectively, agricultural yields remain low and it is then difficult and expensive to transport limited produce to the market. Insufficient producer goods also constrain people's productive capacity and therefore the human capital at their disposal. Access to a good transport infrastructure and producer goods, will

also depend on the willingness and ability of the structures and processes in place to provide them. If they do not provide transport infrastructure, then it will hinder the smooth transportation of goods and also increase the cost of transportation (Odabode, 2004).

Structures and processes are formal and informal institutions and organisations that shape livelihoods by influencing access to assets, livelihood strategies, vulnerability and terms of exchange. They occur at multiple levels, from the household to community, national and even global levels. The public and private sectors, civil society and community institutions are also relevant considerations. Laws, policies and culture can also be included. These structures and processes sometimes engineer the shocks, trends and seasonality of people (Adato & Meinzen-Dick, 2002).

Livelihood strategies are the ranges and combination of activities and choices that people make and undertake in order to achieve their livelihood outcomes (DFID, 1999). People will pursue many livelihood strategies, either to make up enough income or provide a measure of security. The pursuit of multiple activities can have important implications for cash and labour availability at different times of the year (Odabode, 2004).

People pursue their livelihood strategies to achieve their livelihood outcomes. These outcomes include conventional indicators such more income (an increase in the amount of money coming into the household); increased well being (an increase in self-esteem, sense of control and inclusion, physical security of household members, their health status and access to goods and services); reduced vulnerability (increased overall social sustainability); improved food security and more sustainable use of the natural resource base (DFID, 1999).

The vulnerability context, livelihood assets, structures and processes, livelihood strategies and livelihood outcomes are concepts that have been used by DFID to develop a livelihood framework. This framework shows how these concepts are interconnected in Figure 1. The vulnerability context (shocks, trends and seasonality) positively or negatively affects access to human, social, physical, natural and financial capitals. The levels of government, private sectors, laws, policies and institutions provide these capitals.

However, the vulnerability context can hamper the abilities of the institutional structures or settings and processes to make these capitals available to people to build their livelihoods. If the structures and processes in place are unable to provide livelihood capitals to people, this will in turn intensify shocks, trends and seasonality. The provision of livelihood capitals to people will enable them to engage in a livelihood strategy that will result to favourable livelihood outcomes such as an increase in their income and well being, reduced vulnerability and improved food security. Favourable livelihood outcomes will in turn enhance the provision of livelihood assets.

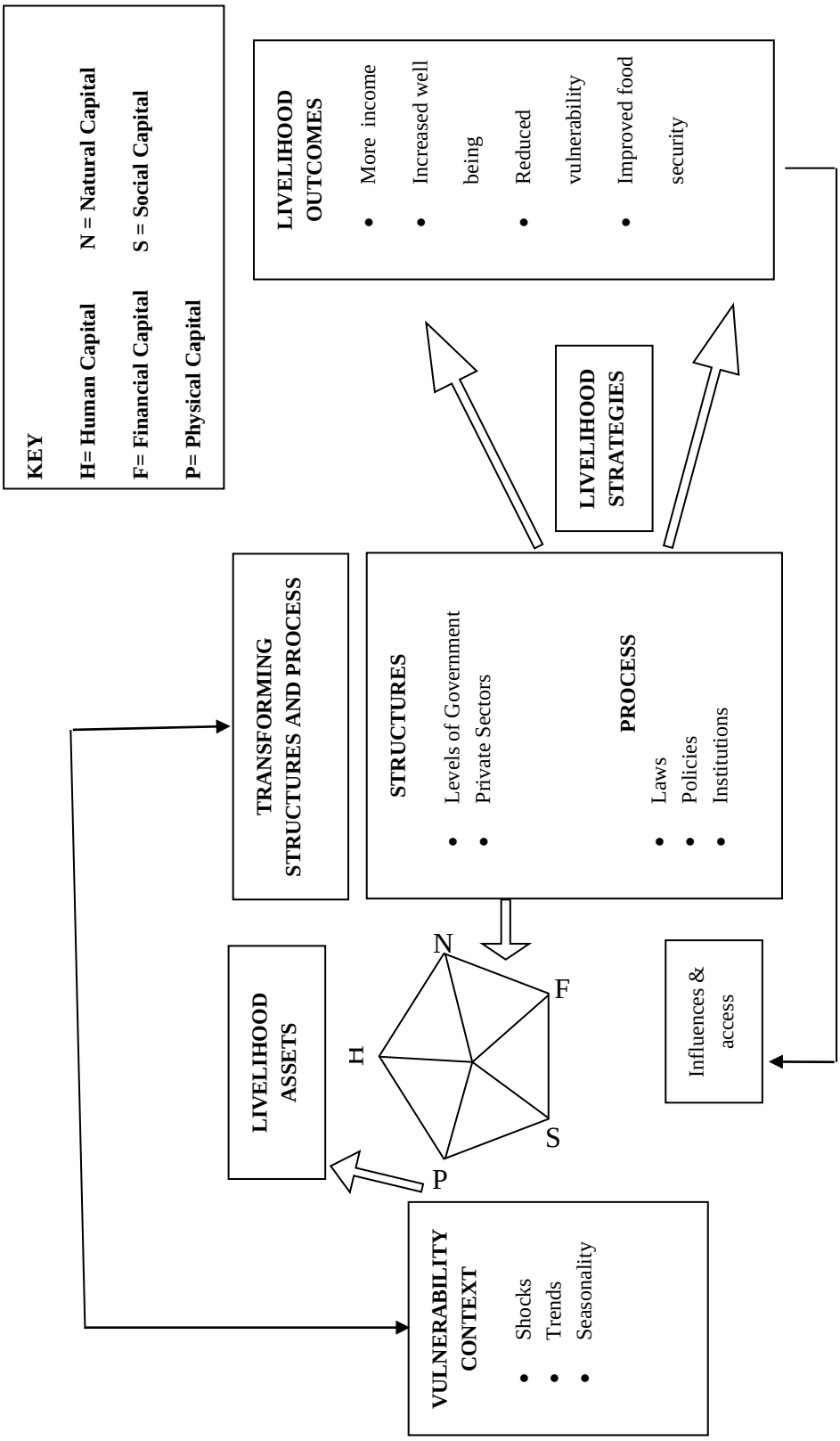

Figure 1: Sustainable Livelihood Framework
Source: DFID, 1999

Empirical studies of maize technologies and its effects on yields and incomes

The empirical studies elaborates on the types of maize technologies (traditional and improved), drawing relevant examples from other countries particularly in Cameroon, of how these technologies have been applied and the effects it has had on the yields and incomes of farmers. Traditional maize technologies examines local white maize (LWM), organic manure, wood ash and kerosene mixture (WAKM), while improved maize technologies examines improved white maize (IWM), improved yellow maize (IYM), inorganic fertilizers, insecticides and herbicides.

The LWM is a local variety of maize produced and used in many parts of Cameroon. It produces lower yields than the improved varieties of maize. The Institute of Agricultural Research for Development (IRAD) proved this by testing the yield potentials of local white maize and CMS 8504, an improved maize variety in the Central and South regions of Cameroon. The results from the test revealed that LWM yielded 2330 kg ha, while CMS 8504 yielded 3540 kg ha. However, another test conducted in a village called Ekona in Muyuka sub-division in the South West region of Cameroon, to test the yield capacities of LWM with the application of fertilizer depicted that LWM yielded 2506 kg ha. Results from the second trial disclosed further that LWM with fertilizer application yielded 3032 kg ha (IRAD, 1994).

Organic manures are wastes and residues from plant and animal life that are left to decompose, in order to provide some level of fertility to the

soil, supply some nutrients to plants and improve the soil structure. Some experiments in tropical countries have tested local animal manures and composts, which have proven to be more effective than inorganic fertilizers. This was discovered by Cooke (1982), in a research conducted in Ghana to compare the quantum of dry grass, kraal manure and inorganic fertilizers and their effects on the yields of farmers. The findings disclosed that a mulch of 12.5t/ha of dry grass, kraal manure at 5 to 10t/ha, nearly always gave better yields than inorganic fertilizers. The findings revealed further that kraal manure, supplied small amounts of nutrients, about 25kg/ha each of N (nitrogen) and 35 kg/ha of K_2O (potassium), which was more than the amount supplied by inorganic fertilizers.

Adamou, Pierre, Pogenet, Tchimbi and Gonlaina (2007) conducted a survey in Mbe sub-division in the Adamawa region of Cameroon to ascertain farmers' perceptions of soil fertility management. They reported that the application of animal manure (cows, ovins and bats) increased the yields of maize by 46.67%.

The WAKM is considered as an organic control for insects. However, it is most effective on small plots with low insect populations. The American Peace Corps Volunteer Association (APCVA) arrived at this conclusion by conducting an experiment to compare the effects of WAKM on the insect population of farm sizes and yields of food crops, such as maize, cocoyams, plantains and cassava, in a village called Ekona in the South West region of Cameroon. The findings from the experiment showed that the mixture was effective on smaller farms of about 1 to 2 acres, since the insect population was low on these farms. However, the mixture was ineffective on larger farms

of 4 to 5 acres, because the insect population was high on these farms. The findings also revealed that the yields of food crops from larger farms were low (maize-2kg, cocoyams, plantains, cassava-1/2 a fertilizer bag each), as a result of an ineffective pest control method (APCVA, 1997).

The IWM is one of the improved maize varieties produced and used in Cameroon. It is an intermediate and sweet variety with white flint kernels. It has a wide spectrum of adaptation and can give maize yield advantages of up to 40% over local maize without fertilizer. IRAD (1990) revealed this in an on-farm trial to compare the yield capacities of IWM and LWM without and with fertilizer applications in Ekona in Muyuka sub-division of the South West region of Cameroon.

Results from the first trial depicted that IWM without fertilizer yielded 2558 kg ha, while LWM without fertilizer yielded 1833 kg ha. The second trial of IWM without fertilizer yielded 2664 kg ha, while LWM yielded 2154 kg ha. Results from the third farm trial to compare the yield capacities of IWM and LWM with fertilizer applications in the same area showed that IWM with fertilizer yielded 3562 kg ha, while LWM yielded 2333 kg ha. The fourth trial of IWM with fertilizer yielded 3350 kg ha, while LWM yielded 3052 kg ha (IRAD, 1990).

The IWM has income advantages over the LWM. This was discovered in a study conducted by IRAD (1990) to evaluate the economic efficiency of IWM, LWM and fertilizer applications in the South West region of Cameroon. The findings from the study showed that IWM had an income advantage over LWM of 20% and 30% with and without fertilizer respectively. These advantages however, varied by zone and season. In Kumba, located in Meme

division in the South West region of Cameroon, the improved variety and fertilizer application gave return rates of 58% in the first season and 26% in the second season. In the lower volcanic zone, the improved variety and fertilizer application gave 33% advantage in the first season and 23% advantage in the second season.

The IYM is another improved maize variety produced and used in Cameroon. It has yield advantages over the local white type of maize. This was proven by IRAD (1994) in farm trials to compare the yield potentials of IYM and LWM in the Central and South regions of Cameroon. The revelations from the first test were that IYM yielded 5570 kg ha, while LWM yielded 4140 kg ha. The second test showed that IYM yielded 9123 kg ha, while LWM yielded 7158 kg ha. The third trial disclosed that IYM yielded 7263 kg ha, while LWM yielded 5249 kg ha.

Inorganic fertilizers are simple chemical compounds made in a factory or obtained by mining which supply plant nutrients, but are not residues of plant or animal life (Cooke, 1982). Farmers apply inorganic fertilizers for two reasons: to obtain reasonable yields and build the soil fertility reserves back to sufficiency levels (Teboh, 2001). The application of inorganic fertilizers for improved yields has been attested by IRAD (1990) in a research to examine the rate of fertilizer application and its contribution to the yields of maize at Yoke in Meme Division in the South West region of Cameroon. The results depicted that an increase of N-P-K rate of fertilizer application from 40-20-20 kg ha to 160-80-80 kg ha, increased the yields of maize from 500 kg ha to 2000 kg ha.

Findings from a survey to ascertain the contribution of inorganic

fertilizers to maize yields in the Eastern and Southern parts of Africa disclosed that 50% to 75% of increases in maize yields from the mid 1960s onwards have been attributed to inorganic fertilizers (Byerlee & Eicher, 1997). Results from another survey conducted in West and Central Africa to ascertain the contribution of inorganic fertilizers to maize yields showed that the application of 50kg N ha of fertilizer, increased maize yields from 2.1% to 4.2% (Naab, 2001).

Insecticides are types of pesticides designed primarily to control insect pests. Plants are susceptible to pests and diseases at all stages of growth. This is why improved pest control methods are adopted by farmers to forestall crop losses, after much efforts and costs have already been invested to cultivate their crops (Gunn & Stevens, 1976). Arnon (1987) for example estimated that 120,000 tonnes to 700,000 tonnes of insecticides were needed to double food production in New York in America.

The adoption of improved pest control technologies can show remarkable yield increases. For example, a study by IRAD (1994) in the forest zone in the Central region of Cameroon showed that 0.1g of Carbofuran insecticide application produced 5138kg/ha of maize with a financial benefit of 684,380FCFA (almost $1400). When the insecticide application rate was increased to 0.2g, the yields of maize increased to 5500kg/ha with a financial benefit of 724,060FCFA (almost $1500). When the Carbofuran insecticide was not applied, the yield of maize was 2789kg/ha with a financial benefit of 376, 515FCFA (almost $800).

Weeds can be controlled by three main methods: chemically by applying herbicides; mechanically through weeding, ploughing or hand-

pulling and physiologically through shading, burning, mulching or smothering. The commonest traditional method of weed control is by weeding (Youdeowei, Ezedinma & Onazi, 1986).

Weeding has been found to have a more favourable effect on maize yield in Cameroon than the use of herbicides. For example, the application of herbicides resulted in a drop of potential maize yield ranging from 30% to 73%. However, in the same country, weed control by combining hand-weeding with Alachlor herbicide at 1.5 kg/ha produced an increase of 1179 kg/ha of maize yield. Hand weeding without any herbicide, produced an increase of 1007 kg/ha in maize yield, while the use of herbicide only at 2.75 kg/ha increased yield by 917 kg/ha (IRAD, 1990). This finding shows that some of the traditional maize farming technologies are more suitable, than the supposed improved technologies introduced to farmers.

Lessons learnt from the theoretical and empirical studies

From the review of literature, it is evident that farmers' use of technology can be influenced by tradition and external or foreign orientation, the affordability and simplicity of technologies, access to the markets, human, social, financial, physical and natural capitals and their demographic characteristics (sex, age group, educational level). It is also evident that the roles played by transforming structures and processes or institutional settings can influence farmers access to capitals to engage in maize farming as a livelihood strategy. Evidence from the literature shows further that improved maize technologies contribute to higher yields and incomes than traditional maize technologies and farmers' perceptions of the contribution of maize

technologies can vary based on their abilities or inabilities to fulfil their livelihood outcomes.

Conceptual framework for maize technologies and farmers' perceptions of livelihoods

Miles and Huberman (1994) canvassed that a conceptual framework explains either graphically or in a narrative form, the main things to be studied; namely, the key factors, constructs or variables and the relationship among them. This framework attempts to show the linkage among the main concepts of the study which include the demographic characteristics of farmers, farmers' views of other factors that influence their use of maize technologies and their perceptions of livelihoods.

The framework shows that the demographic characteristics of farmers in terms of their sex, age group and educational level can influence their use of maize technologies. Farmers' views of other factors that may influence their use of technology are the affordability and simplicity of farming technologies, traditional and external influence, access to the markets, human, social, natural, physical and financial capitals (Figure 2).

Human capital is the skill acquired by farmers to apply their maize technologies; social capital refers to group membership and conditions attached for group membership; natural capital refers to farmers' access to land; physical capital is farmers' access to farm to market roads that will enable them to conveniently transport their maize produce; financial capital refers to farmers' access to credit and savings.

The transforming structures and processes refer to the extension officers, who provide the skills to farmers to apply maize technologies by organising training sessions for them, paying visits to their maize farms, communicating to them through the media, popular theatre and field demonstrations and helping farmers to adopt and diffuse maize technologies to their colleagues.

Parents of farmers also provide some skills to them to apply maize technologies. The farmers' groups present conditions to farmers, which they must accept and abide by to enable them obtain group membership. The delegation for agriculture and rural development, constructs farm to market roads to enable farmers to conveniently transport their maize. The traditional rulers and private individuals provide farm land to farmers by either selling or giving it to them as a gift. In selling land to a farmer, a traditional ruler or private individual will attach certain conditions, which the farmer must fulfil to acquire full ownership of the land. The credit unions and farmers' groups ensure that farmers must fulfil certain conditions in order for them to provide credit. The farmers' and traditional groups create conditions for farmers to save money in the groups.

The structures and processes provide the capitals to enable farmers to adopt maize technologies (traditional and improved). The adoption of these technologies will enable farmers to pursue maize farming, as a livelihood strategy. Farmers who adopt traditional technologies may be unable to fulfil their livelihood outcomes, while farmers who adopt improved technologies may be able to satisfy their livelihood expectations.

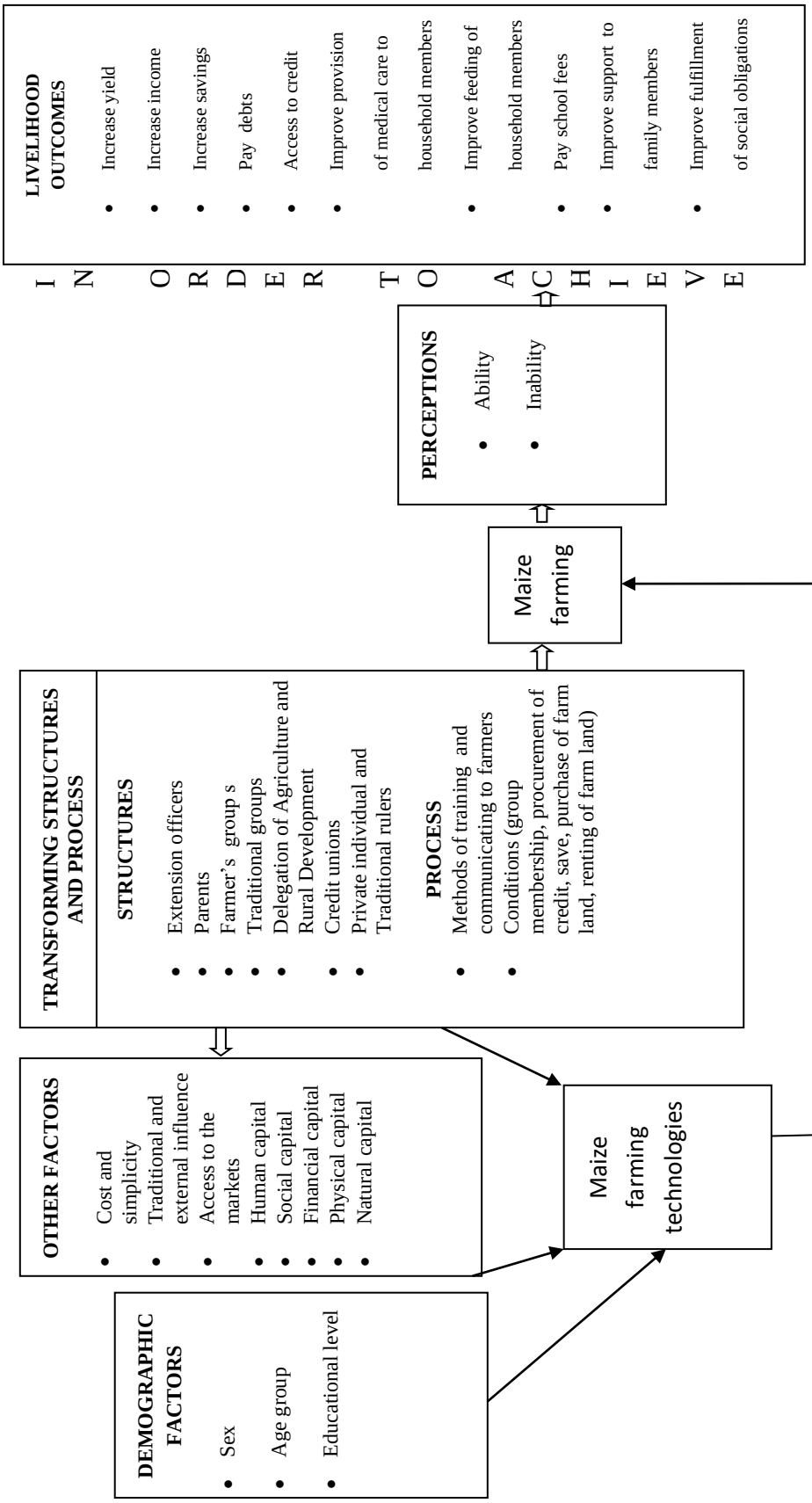

Figure 2: Maize technologies and farmers' perceptions of livelihoods

Source: Author's construct, 2009

The livelihood outcomes of both groups of farmers refers to their inabilities or abilities to increase yields, incomes, savings, pay debts, have access to credit, improve the provision of medical care and feeding of household members, pay school fees for their children, improve their support to family members and fulfilment of social obligations.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter comprises discussions on the procedures and techniques used to collect and analyse data for the research. It contains a description of the study area, research design, study population, sample size, sampling procedures, instruments for data collection, pre-test and data collection and the methods for data analysis.

Study area

Buea is a sub-division, situated in Fako Division in the South West region of Cameroon. Fako Division is one of the six divisions in the region. The region is one of the ten regions in the country and also one of the two Anglophone regions in the country. Buea sub-division is a forest zone with volcanic soil, arising from the eruption of the Fako Mountain over the years. The sub-division, as shown in Figure 3, is bordered in the North and West by the flank of Mount Fako otherwise known as Mount Cameroon, South by Limbe sub-division and East by Tiko sub-division (National Plan Fako-NPF, 2000).

Buea sub-division is situated between latitude 4˚ 4’ and latitude 4˚ 16’, North of the Equator and longitude 9˚ 13’, East of the Meridian. The land drops

sharply from the summit of Mount Cameroon to Buea town area and then the drop continues gently to the other parts of the sub-division. The summit of Mount Cameroon is 4090m above the sea level (NPF, 2000). The texture of the volcanic soil and the topography of the land promote enormous infiltration of rainfall, giving rise to a great amount of perennial surface water (permanent flow of several rivers and streams in the sub division).

Buea sub-division, as shown in Figure 3, is divided into twenty communities (Bolifamba, Dibanda, Great Soppo, Bonduma, Molyko, Bokwi, Bokova, Bonakada, Bova, Bwitingi, Mamu, Muea, Lysoka, Bomaka, Bwassa, Bonjongo, Bokwango, Sasse, Tole and Small Soppo). These communities are predominantly inhabited by the natives who are called the Bakwerians. The inhabitants, most of whom are farmers (commercial and subsistence) are engaged in cash crop, food crop and fruits production, while others are engaged in other jobs such as teaching and performing administrative duties. The cash crops that are grown in the sub-division are cocoa, coffee and palm nuts. Food crops such as cocoyam, plantain, cassava, yam, maize and vegetables (cocoyam leaves, cabbages, bitter leaves, huckle berry, green vegetables, tomatoes and beans) are grown. Fruits such as oranges, pineapples, plums, mangos, sugarcane, grapes and pears are also grown. Animal husbandry, hunting, bee keeping, snail rearing and mushroom cultivation are other economic activities carried out by farmers. However, of all these activities, maize cultivation is one of the main economic activities of farmers in the sub-division (NPF, 2000).

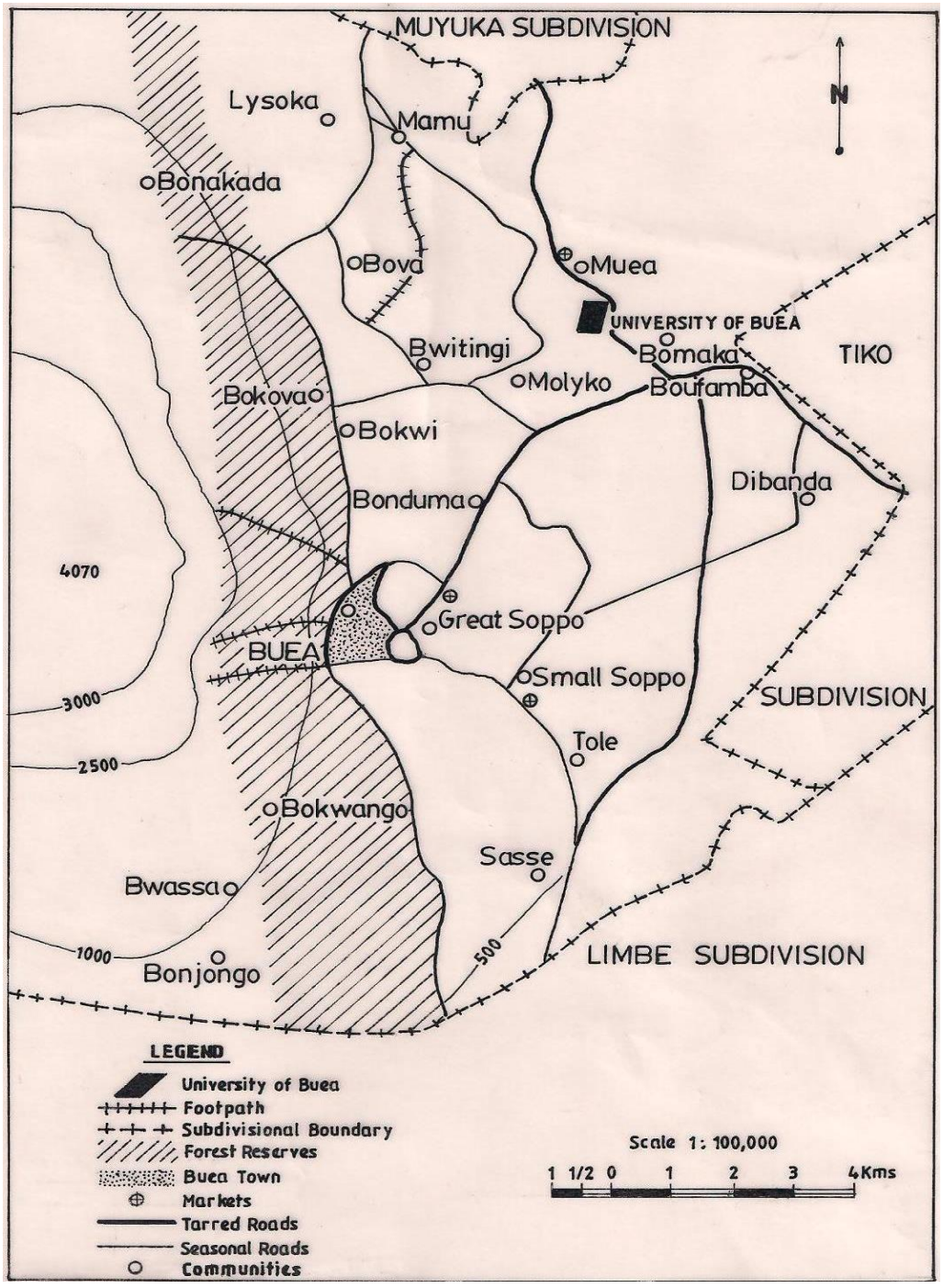

Figure 3: Buea Sub-Division

Source: National Plan Fako, 2000

Research design

The ex post facto design was used for the study. Johnson (2001) maintains that the ex post facto design enables researchers to examine existing conditions and collect data to investigate a possible relationship between factors and subsequent characteristics or behaviours. The design has independent and dependent variables. It involves no direct manipulation of the independent variables and assumes that the presumed cause of an event has already occurred. However, the weakness with this design is that it does not allow us to draw firm conclusions about the cause and effect of an event, because we cannot control for confounding variables that may provide alternative explanations for any group differences that may have been observed.

The ex post facto design was appropriate for this study because, it examined existing conditions: farmers using traditional and improved maize technologies. The independent variables were the farming technologies: traditional (organic manures, local white type of maize, wood ash and kerosene mixture) and improved (inorganic fertilizers, improved white and yellow maize, insecticides, and herbicides). The dependent variables were the yields and farm incomes of farmers. Data was collected on the yields and farm incomes of farmers using traditional and improved maize technologies for comparison.

Study population

The study population was made up of all registered maize farmers in the Buea sub-division and the agricultural extension officers in the sub-division. There were 266 maize farmers registered with the BSDDARD at the time of the

study, while the number of extension officers was four. Details of the population of maize farmers are presented in Table 1.

Table 1: Details of study population

Communities	Males	Females	Total
Bolifamba, Dibanda, Great Soppo	60 (55.0)	49 (45.0)	109 (100.0)
Bonduma and Molyko and Bokwi			
Bokova, Bonakada	33 (43.4)	43 (56.6)	76 (100.0)
Bova, and Bwitingi			
Lysoka, Mamu, Muea,	23 (45.1)	28 (54.9)	51 (100.0)
Bomaka and Bwassa	17 (56.7)	13 (43.3)	30 (100.0)
Bonjongo, Bokwango			
Sasse, Tole and Small Soppo			
	133 (50.0)	133 (50.0)	266 (100.0)

Note: Figures in parentheses are row percentages

Source: Field survey, 2009.

Table 1 shows that the number of male farmers in the Buea sub-division is equal to the number of female farmers. However, 55% and 56.7% of the farmers in the Bolifamba, Dibanda, Great Soppo, Bonduma, Molyko, Bwassa, Bonjongo, Bokwango, Sasse, Tole and Small Soppo communities are males, while 56.6% and 54.9% of the farmers in the Bokova, Bokwi, Bonakada, Bova, Bwitingi, Mamu, Muea, Lysoka and Bomaka communities are females.

Sample size

The sample sizes for the communities were drawn using Krejcie and Morgan's table cited in Sarantakos (1993) for determining the sample size from a given population. They maintained that for a population of 109, the required sample size is 80; for a population of 76, the required sample size is 63; for a population of 51, the required sample size is 44; for a population of 30, the required sample size is 28. These recommendations are based on a margin of error of 5% and a confidence level of 95% and the fact that the actual population may be unknown.

Therefore, a total of 215 maize farmers in the Buea sub-division were randomly selected for the study (80 farmers from the Bolifamba, Dibanda, Great Soppo, Bonduma and Molyko communities; 63 farmers from the Bokova, Bokwi, Bonakada, Bova and Bwitingi communities; 44 farmers from the Lysoka, Mamu, Muea, Bomaka and Bwassa communities; 28 farmers from the Bonjongo, Bokwango, Sasse, Tole and Small Soppo communities) as shown in Table 2. All four extension officers in the sub-division were selected for the study.

Table 2: Selected sample size

Communities	Sample sizes
Bolifamba, Dibanda, Great Soppo, Bonduma and Molyko	80
Bokova, Bokwi, Bonakada, Bova and Bwitingi	63
Lysoka, Mamu, Muea, Bomaka and Bwassa	44
Bonjongo, Bokwango, Sasse, Tole and Small Soppo	28
Total	215

Source: Field survey, 2009.

Sampling procedures

The simple random sampling technique was adopted to select the farmers in the study. In using the simple random sampling technique, numbers were randomly generated using the Statistical Product and Service Solutions (SPSS) version 12.0. The simple random sampling technique was used for the study because high reliability, degree of representativeness and high generalisability of the research results were guaranteed (Sarantakos, 1993).

A sampling frame which constituted the listed names of farmers in the sub-division was obtained from the BSDDARD. Instructions were given to the computer to randomly print numbers for the communities. For example, instructions were given to the computer to randomly print 80 numbers from 1 to 109 for the Bolifamba, Dibanda, Great Soppo, Bonduma and Molyko communities; 63 numbers between 1 to 76 for the Bokova, Bokwi, Bonakada, Bova and Bwitingi communities; 44 numbers from 1 to 51 for the Lysoka, Mamu,

Muea, Bomaka and Bwassa communities; 28 numbers from 1 to 30 for the Bonjongo Bokwango, Sasse, Tole and Small Soppo communities. The names on the sampling frame for these communities that corresponded to the numbers chosen by the computer were identified and chosen as the subjects for the study. All the extension officers in the sub-division were interviewed, because they were respondents thought to be relevant for the study.

Instruments for data collection

Primary data were collected using the structured interview schedule and questionnaire. The interview schedule was used to interview farmers, because most of them had low level of education. The schedule was read in the local language (the Bakweri language) and Pidgin English otherwise known as Broken English, because these were the languages best understood by farmers. The questionnaire was used to collect data from the extension officers, because they were more educated and therefore could read and write.

Primary data were collected to reflect the specific objectives. The interview schedule was divided into four main parts. Part one examined the association between the demographic characteristics (sex, age groups and educational level) of farmers and their use of maize technologies. Part two examined farmers' views of other factors, that is (cost and simplicity of farming technologies, traditional and external influence, access to the markets, livelihood capitals, structures and processes) that influence their usage of maize technologies. Part three compared the yields and incomes of farmers who used traditional maize technologies to those who used improved maize technologies

from 2006 to 2008. The incomes of farmers were derived by multiplying the average price for maize per year by the yields. Part four examined the livelihood perceptions of the different groups of farmers from 2006 to 2008.

The questionnaire specifically addressed objective five, which was related to the role played by extension officers in enabling farmers to adopt and diffuse maize technologies. It was divided into two parts. Part one examined the demographic characteristics of extension officers. Part two examined the role played by extension officers in enabling farmers to adopt and diffuse maize technologies. The structure of questions in the instruments was a combination of open-ended and close-ended questions.

Pre-test and data collection

A pre-test was conducted in a village called Ekona in the Muyuka sub-division of Fako division, to test the data collection instruments for reliability and validity. Ekona was chosen because farmers in this village, like those in the Buea sub-division, cultivate maize as one of their main economic activities on large scale (seed producers) and small-scale basis. Like in the Buea sub-division, maize is also cultivated in Ekona twice a year. The village also has similar characteristics with Buea sub-division in terms of the type of crops grown, its climatic conditions and soil texture (NFP, 2000).

The staffs of the BSDDARD and farmers in the sub-division were reached through the sub-delegate of the office. The farmers and extension officers in Ekona were reached through the chief of post for agriculture and rural development in the village. The pre-test was conducted on the 25th January, 2009

and the instruments for data collection (structured interview schedule and questionnaire) were modified on the 1st February, 2009. Data collection began on the 8th February, 2009 and ended on the 10th March, 2009. These activities were carried out with the assistance of the junior staff of the BSDDARD,

Methods of data analysis

SPSS version 12.0 was used to screen, clean and analyse primary data to reflect the specific objectives. The categorical variables were coded. Errors were checked by running and inspecting frequencies, to make sure that their maximum and minimum values corresponded with the codes at the variable view.

The associations between the demographic characteristics of respondents and their use of maize technologies were analysed using the chi square test of independence. Cross tabulation of frequencies, pie charts and bar graphs were used to examine the respondents' views of other factors that influence their use of maize technologies and the livelihood perceptions of the different groups of respondents. The Mann Whitney U-Test was used to compare the yields and incomes of the respondents who used traditional technologies to their counterparts who used improved technologies.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the results and discussions from the data analysis. The results were presented in five parts to reflect the objectives of the study. The first part dealt with the demographic characteristics of farmers and their use of maize technologies, while the second, third, fourth and fifth parts dealt with farmers' views of other factors that have influenced their usage of maize technologies, a comparison of their yields, incomes and livelihood perceptions and the role played by extension officers, in enabling farmers to adopt and diffuse maize technologies respectively. The total number of farmers that were interviewed was 215 (61 farmers used traditional technologies, while 154 farmers used improved technologies).

Demographic characteristics of farmers and their use of maize technologies

The demographic characteristics were described in terms of the sex, age groups and educational level of farmers, who used traditional and those who used improved maize technologies. The chi square test of independence was used to analyse the associations and the results are presented in subsequent paragraphs.

Sex of farmers and their use of maize technologies

Out of the 215 farmers that were sampled for the study, 124 were males, while 91 were females. The farmers who used traditional technologies were 61, while their counterparts who used improved technologies were 154. About 32 (52.5%) out of 61 and 92 (59.7%) out of 154 of the male respondents used traditional and improved technologies respectively as shown in Table 3. This implies that the males were dominant in using both technologies.

Table 3: Sex of farmers and their use of maize technologies

Technologies	Males		Females		Total		χ^2	Sig.
	Freq.	%	Freq.	%	Freq.	%		
Traditional	32	25.8	29	31.9	61	28.4	0.674	0.41
Improved	92	74.2	62	68.1	154	71.6		
Total	124	100.0	91	100.0	215	100.0		

Source: Field data, 2009.

In trying to ascertain whether or not an association exist between the sex of respondents and their use of maize technologies, it was hypothesised that:

H_o: There is no significant association between the sex of farmers and their use of maize technologies.

H_1: A significant association exists between the sex of farmers and their use of maize technologies.

The results in Table 3 show that the sex of farmers in no way influenced their usage of maize technology, as indicated by the χ^2 value of 0.674, with its

associated p-value of 0.41. Pallant (2001) stated that for a test to be considered significant, the p- value must be equal to or smaller than 0.05. The test was therefore not significant and H_o was accepted. The findings therefore indicate that most male and female respondents adopted similar maize technologies. The results did not corroborate Nelson's (1981) proposition that farming technologies should be designed differently for men and women because of their different needs and desires in farming. The findings did not also affirm Feldstein and Poats's (1997) and Campbell and Barker's (1997) admonition that appropriate technologies should be developed separately and included for women in extension programmes, taking into cognisance the particular functions such as planting, replanting, weeding, seed selection and storage, they perform in the farming system and their work schedule in the household environment.

Age groups of farmers and their use of maize technologies

The results in Table 4 indicate that 154 out of 215 farmers were between the ages of 36 years to 55 years. Similarly, 42 (68.9%) out of 61 of the traditional technology users and 112 (72.7%) out of 154 of the improved technology users were between 36 years to 55 years respectively. This meant that the majority of respondents in both groups were middle aged. Based on the classifications of farmers' age groups by the Ministry of Agriculture and Rural Development (MARD) in Cameroon, farmers who fall between 36 years to 55 years are considered middle aged, while farmers who fall between 20 years to 35 years are considered young and farmers who are 56 years and above are considered old (BSDDARD, 2006).

Table 4: Age groups of farmers and their use of maize technologies

Technologies	20-35		36-55		56+		Total		χ^2	Sig.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Traditional	13	32.5	42	27.3	40	72.7	61	28.4	0.427	0.80
Improved	27	67.5	112	72.7	15	27.3	154	71.6		
Total	40	100.0	154	100.0	55	100.0	215	100.0		

Source: Field data, 2009.

To examine whether or not an association exist between the age groups of respondents and their usage of maize technologies, the following hypothesis were formulated and tested:

H_o: There is no significant association between the age groups of farmers and their use of maize technologies.

H_1: There is a significant association between the age groups of farmers and their use of maize technologies.

Though the majority of farmers were middle aged, this did not reflect in a significant association between their age groups and technology adoption. This is because a chi square analysis yielded a χ^2 statistic of 0.427, with a p-value of 0.80. Thus, the age groups of farmers did not influence their adoption of maize technologies. The findings did not conform to the CIMMYT (1993) position that younger farmers are likely to adopt a new farming technology, because they are more educated and cosmopolitan than the older generation. The results also defy Swanson et al.'s (1997) argument that more old people are engaged in agriculture in the rural areas, because of the low level of technology it employs.

Educational level of farmers and their use of maize technologies

The findings in Table 5 disclose that 166 out of 215 respondents had a low level of education. Similarly, about 42 (68.9%) out of 61 of the respondents who used traditional technologies and 124 (80.5%) out of 154 of the respondents who used improved technologies, had a low level of education respectively. This implies that majority of the farmers in the Buea sub-division had a low level of education. The MARD classifies farmers who have obtained the First School Leaving Certificate, General Certificate of Education Ordinary Level and the Professional Aptitude Certificate as having a low level of education. Farmers who have obtained the General Certificate of Education Advanced Level, as well as those who are graduates, are classified as having a high level of education (BSDDARD, 2006).

Table 5: Educational level of farmers and their use of maize technologies

Technologies	Low		High		Nil		Total		χ^2	Sig.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Traditional	42	25.3	8	32.0	11	45.8	61	28.4	4.533	0.10
Improved	124	74.7	17	68.0	13	54.2	154	71.6		
Total	166	100.0	25	100.0	24	100.0	215	100.0		

Source: Field data, 2009.

To examine whether or not an association exist between farmers' educational levels and their adoption of maize technologies, it was hypothesised that:

H_o: There is no significant association between farmers' educational level and their use of maize technologies.

H_1: A significant association exists between farmers' educational level and their use of maize technologies.

The results in Table 5 depict that the educational level of farmers did not influence technology adoption (χ^2 = 4.533, p-value= 0.10) at the 5% level of significance. Irrespective of whether farmers were lowly or highly educated or did not receive any formal education, most of them adopted similar maize technologies. The findings contradict the postulation of Chung (1991) that literacy level among farmers is highly correlated with the utilisation of modern technology.

The result also challenges Aryeetey's (2004) claims that the educational level of farmers to a greater extent influences the types of technologies that they may choose or adopt in an agricultural programme. However, considering the findings of Leonard (1977), farming technologies that are quite simple and do not involve complicated activities are easily adopted by farmers with low literacy levels. In fact, Leonard (1977) noted that people with only primary school background could perform and disseminate agricultural innovations more effectively than those with secondary school background.

As claimed by Gamble and Gamble (2002), a high level of education sometimes become a barrier, rather than a facilitator or aid to communication. The results of the study can therefore be explained by the simplicity of the various practices in both the improved and traditional maize technologies. It also points to

the possibility that what prevents other farmers from adopting the improved technology may be more financial than technical or attitudinal factors.

Farmers' views of other factors that influence their usage of maize technologies

The views of farmers with regard to other factors that influence their usage of maize technologies were examined in terms of the reasons for their choice of selected maize technologies, human, social, financial, physical, natural capitals and their supporting structures. Cross tabs, pie charts and bar graphs were used to analyse these factors and report the differences in proportions for farmers who used traditional technologies and those who used improved technologies.

Reasons for farmers' choice of selected maize technologies

The decision to adopt a technology is based on a number of considerations. Table 6 presents the reasons for farmers' choice of traditional and improved maize inputs and varieties. The results reveal that 40 (65.6%) out of 61 of the traditional technology users stated that their selected technologies were less costly than improved maize technologies. Furthermore, the findings show that 11 (18%) out of 61 of the farmers who used traditional technologies, found it easier to understand the technologies than improved technologies. Ten (16.4%) out of the 61 respondents who used traditional technologies disclosed that the technologies were their traditional way of cultivating maize. The study depicted clearly that farmers continue to use the traditional maize technology for economic reasons. This confirms the observation made earlier in this study and also the

assertion by Reijntjes et al. (2006) concerning the fact that inputs needed for using improved technologies are usually not affordable to the poor farmers, which lures them to adopting traditional inputs as an alternative.

Table 6: Reasons for farmers' choice of traditional and improved maize inputs and varieties

Reasons	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Less costly	40	65.6	0	0.0	40	18.6
Easy to understand technologies	11	18.0	30	19.9	41	19.0
Traditional way of cultivating maize	10	16.4	0	0.0	10	4.7
Easy access to the markets	0	0.0	90	58.0	90	41.9
External influence	0	0.0	34	22.1	34	15.8
Total	61	100.0	154	100.0	215	100.0

Source: Field data, 2009.

However, with regard to the 154 farmers who adopted improved technologies, 90 (58%) disclosed that they did so because it afforded them easy access to the markets. Thirty four (22.1%) chose improved technologies because, they had been influenced by the results of these technologies used by other farmers and 30 (19.9%) of the same group of farmers found it easier to understand

the use of improved technologies than traditional technologies. The results of this group of farmers confirms the proposition of Reijntjes et al. (2006) that the chances of indigenous people in the market can only be improved by way of modern technology.

Human capital and its supporting structure

The study examined human capital and its supporting structure in terms of the source of farmers' skills to apply maize technologies, how farmers were trained by extension officers, farmers' reasons for being satisfied and not satisfied with the training given to them by extension officers, as well as their reasons for being trained by their parents.

The results in Table 7 show that 57 (93.4%) of the 61 farmers who used traditional maize technologies were trained by their parents, as compared to 5 (3.2%) of the 154 users of improved maize technologies who were also trained by their parents. On the contrary, 149 (96.8%) of the 154 farmers who used improved maize technologies were trained by extension officers to apply their maize technologies, while only 4 (6.6%) of the 61 users of traditional technologies had been trained by extension officers.

This implied that majority of the farmers who used traditional technologies may not have had access to the services of extension officers. The majority of the improved technology users had access to the services of extension officers to apply their maize technologies. This shows the importance of extension services in the adoption of innovations. In most developing countries, very few agricultural extension agents are assigned to a large number of farmers. The Food

and Agriculture Organisation (1990) estimates that the number of economically active farmers in developing countries who receive extension services each year is one in five (20%).

Table 7: Source of farmers' skills to apply maize technologies

Source	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Parents	57	93.4	5	3.2	62	28.8
Extension officer	4	6.6	149	96.8	153	71.2
Total	61	100.0	154	100.0	215	100.0

Source: Field data, 2009.

Sometimes, the willingness and readiness of farmers to invest their time and resources in improving their skills and competencies plays a significant role in the adoption process. DFID (1999) noted that human capital can be accumulated, if people are willing and able to invest by attending training sessions or schools. In this case, farmers who used improved technologies obtained their skills from extension officers to apply maize technologies because, they were willing and able to invest in attending training sessions organised by them. This was contrary to their counterparts who used traditional technologies, but were not able to invest in attending training sessions organised by extension officers.

Extension officers use lectures on a weekly basis, field demonstrations, on-the-spot training and advice, as the methods to train farmers in applying maize technologies.

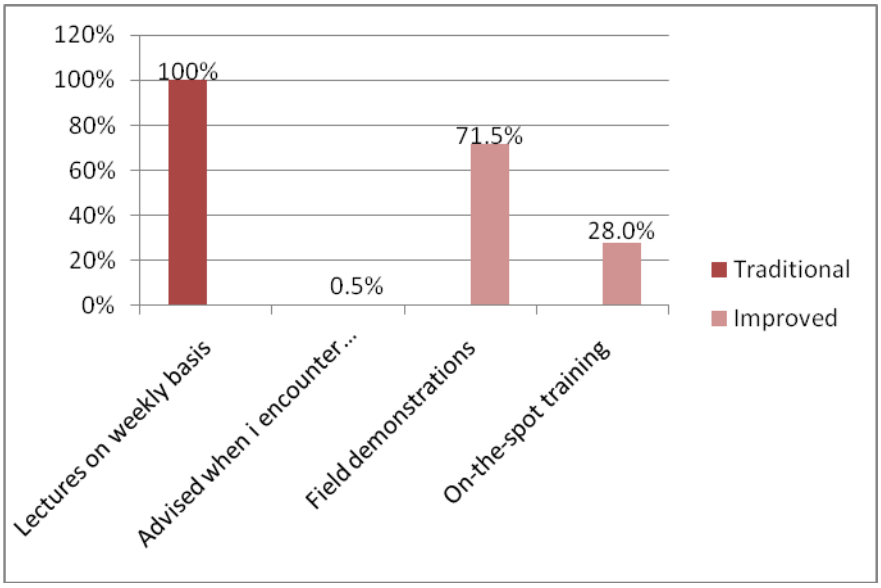

Figure 4: Methods of training farmers by extension officers

Source: Field data, 2009.

The findings in Figure 4 show that all the 4 traditional technology users, who were trained by extension officers were given lectures on a weekly basis, while 106 (71.5%) of the 154 improved technology users who obtained their skills from extension officers were trained by field demonstrations. About 42 (28%) of the users of improved technology received on- the-spot training, and 1 (0.5%) improved technology respondent was advised by an extension officer on what to do, whenever he or she encountered any difficulties.

More farmers can be attracted to agricultural extension training programmes through satisfying training methods and environments. Satisfaction is derived from various reasons as was found in this study. Table 8 presents the reasons advanced by the farmers, who have received training from extension agents, for being satisfied with the training given to them. There were 153 farmers (4 traditional technology users and 149 improved technology users) who received training from extension agents. About 143 farmers were satisfied with

the services of extension officers, while 10 farmers were not satisfied.

Table 8: Reasons for farmers' satisfaction with the training of extension officers

Reasons	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
My yields have increased	0		82		82	57.3
Have obtained new techniques	0		25		25	17.5
My income has increased	0		16		16	11.2
Helps me to do good farm management	0		10		10	7.0
I understand the lessons	0		10		10	7.0
Total	0		143		143	100.0

Source: Field data, 2009.

Findings from the analyses presented in Table 8 revealed that none of the users of traditional technology were satisfied. However, about 82 of the 143 improved technology users who were satisfied with the training outcomes of extension agents disclosed that their yields had increased. The other users of improved technology were satisfied with the training sessions of extension officers because they had obtained new techniques on how to apply maize technologies. These users, have also been able to apply good farm management practices, increased their incomes and understood the lessons of extension officers, as the outcomes of the training sessions they have attended.

All the 4 traditional maize technologies users who had access to extension services were not satisfied with the services because, they had not acquired enough skills to apply their maize technologies. This suggests that low competency in the application of innovative practices is a hindrance to adoption of innovative technologies. Similarly, 6 of the farmers who used improved technologies were also not satisfied with the outcomes of training offered to them by agricultural extension agents because, they could not attain the expected competencies. They were not able to acquire enough skills to apply their improved maize technologies efficiently and effectively. This gives an indication that the extension officers need to improve on their services to cover their clientele.

The results indicate further that 62 (57 traditional technology adopters and 5 improved technology adopters) out of the 215 farmers who were interviewed, acquired their skills to apply maize technologies from their parents rather than extension agents. The reasons that were given by the two groups of adopters for being trained by their parents are displayed in Figure 5.

The major reason that was given by 39 (68.4%) of the 57 adopters of traditional technologies and 4 (80%) of 5 of their counterparts who adopted improved technologies was that they did not have money to attend training sessions organised by extension agents. This espouses the claims of DFID (1999) that human capital can be accumulated, if people are willing and able to invest by attending training sessions or schools. In this case, some farmers from both groups could not obtain their skills from extension officers because, they were

unable to pay for training sessions organised by them. Other reasons that were given by both groups of farmers were that they did not have time to attend training sessions organised by extension officers, or their parents were already experienced farmers. It becomes evident here that affordability of innovations in terms of money and time is an important factor that influences adoption of innovations.

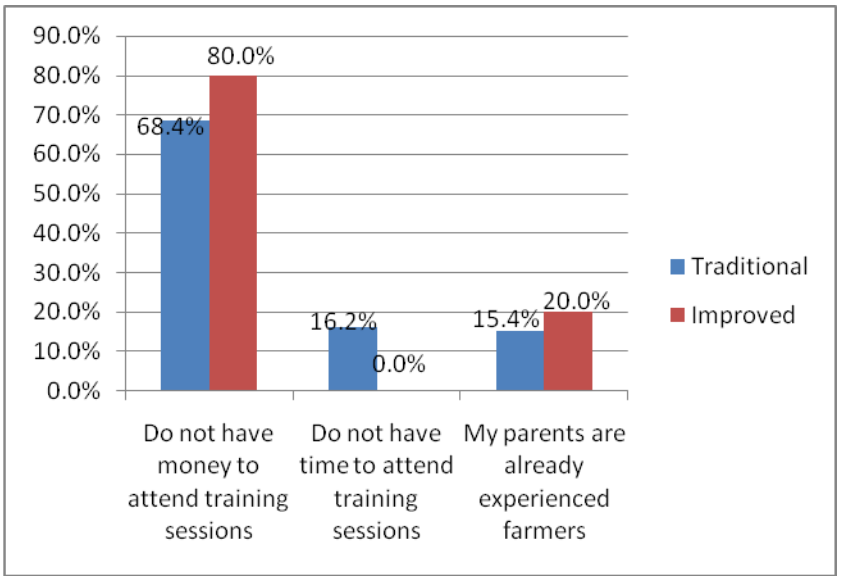

Figure 5: Reasons advanced by farmers for being trained by their parents

Source: Field data, 2009.

Social capital and its supporting structure

Social capital and its supporting structure was examined in terms of farmers membership in groups and whether or not conditions were attached to membership in the groups. Farmers' reasons for being satisfied and not satisfied with the conditions attached to membership in their groups and their reasons for not belonging to a group were also examined.

Table 9: Farmers' membership in groups

Membership in groups	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Yes	4	6.6	144	93.5	148	68.8
No	57	93.4	10	6.5	67	31.2
Total	61	100.0	154	100.0	215	100.0

Source: Field data, 2009.

The findings in Table 9 depict that 57 (93.4%) of the 61 farmers who used traditional technologies did not belong to a group, while 148 (93.5%) out of the 154 farmers who used improved technologies belonged to a group. These groups were quite formalised, requiring members to adhere to certain laid down conditions. De Haan's (2000) asserts that social capital can be developed through membership of more formalised groups, which entails adherence to mutually agreed or commonly accepted rules, norms and sanctions.

The farmers (traditional technology and improved technology users) who belonged to groups expressed satisfaction with the conditions attached to group membership. They however had different reasons for being satisfied with group conditions as shown in Table 10.

Table 10: Reasons for farmers' satisfaction with conditions attached for group membership

Reasons	Freq.	%
My money is secured in the group	52	35.1
Made members committed	25	16.9
I save and have access to loans	18	12.2
Identified me as a group member	13	8.8
It has united group members	13	8.8
Made group members to work very hard	7	4.7
Propelled the growth and financing of our group	7	4.7
Conditions for membership are easy to abide by	5	3.3
Registration fees are low	4	2.7
Acquired knowledge from the group	2	1.4
Instilled discipline in group members	2	1.4
Total	148	100.0

Source: Field data, 2009.

The main reason that was given by the farmers for being satisfied with the conditions attached to membership in their groups was that their money was secured in the groups. This confirms De Haan's (2000) argument that social capital can be developed through networks and connectedness, relationship of trust, reciprocity and exchanges. Networks and connectedness are either vertical

(patron/client) or horizontal (between individuals with shared interests) that increase people's trust and ability to work together. Relationships of trusts, reciprocity and exchanges facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor. This has made both groups of farmers believe that their money is secured in their groups.

Other reasons that were given by the farmers as illustrated in Table 10 were that members have become committed to the group. Some of the farmers also disclosed that they have been able to save and have access to loans and have also been identified as group members. Unity and hard work among group members were some of the reasons given by farmers for their satisfaction with the conditions for group membership.

Some of the farmers indicated further that the conditions have propelled the growth and financing of their groups and were also easy to abide by. Few of the farmers revealed that they have been able to acquire knowledge, as a result of their membership in groups. Low registration fees for and discipline among group members were also some of the reasons, advanced by both groups of farmers for their satisfaction with group conditions.

The farmers who did not belong to groups gave two prominent reasons as illustrated in Figure 6. The findings indicate that 51 (94.4%) out of the 57 farmers who used traditional technologies did not belong to groups because they were unreliable. Seven (53.8%) of the 10 improved maize technology users who were not in groups declared that they were often too busy and therefore, did not have time to attend group meetings.

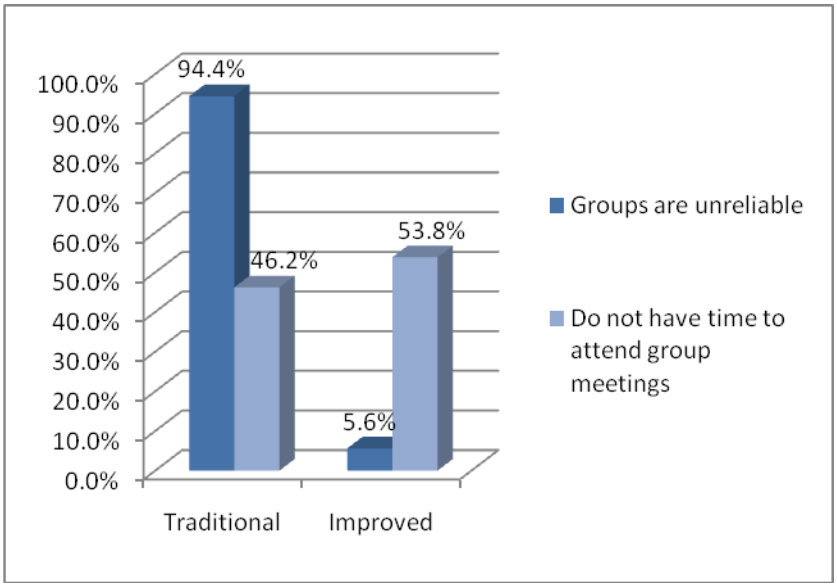

Figure 6: Reasons advanced by farmers for not belonging to groups

Source: Field data, 2009.

Financial capital and its supporting structures

Financial capital and its supporting structures were examined in terms of the source of farmers' money for the purchase of their maize technologies, farmers' reasons for being satisfied and not satisfied with the conditions attached for the procurement of credit from their groups or credit union. Farmers' reasons for not raising money from credit sources and their reasons for being satisfied and not satisfied with the conditions to save in their farmers' or traditional groups were other aspects of financial capital that were examined.

The findings presented in Table 11 show that farmers raise money for the purchase of their maize technologies from savings in their farmers' or traditional groups, relatives, friends and credit obtained from their credit unions or farmers' groups. About 49 (80.3%) of the 61 farmers who used traditional technologies,

raised their money from group savings, while 73 (47.4%) out of 154 of their counterparts who used improved technologies raised their money from credit procured from their farmers' groups or credit unions.

Table 11: Ways in which farmers raise money for the purchase of maize technologies

Ways in which money is raised	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Savings from farmers' or traditional groups	49	80.3	46	29.9	95	44.2
Relatives	10	16.4	31	20.1	41	19.0
Friends	2	3.3	4	2.6	6	2.8
Credit from farmers' groups or credit unions	0	0.0	73	47.4	73	34.0
Total	61	100.0	154	100.0	215	100.0

Source: Field data, 2009.

The results indicated that only the adopters of improved technologies raise money from credit sources for the purchase of their technologies. Of the 73 adopters who raise money from credit, 66 expressed satisfaction with the conditions attached for their procurement of credit, while 7 were not satisfied with the conditions. Figure 7 presents the reasons canvassed by this group of adopters for being satisfied with the conditions attached for the procurement of credit from their groups or credit unions. The findings depicted that 39 (53.4%) of the 66

improved technology users were satisfied with the conditions attached for their procurement of credit because, they were able to save and have access to loans.

This supports DFID's (1999) position that access to financial capital is supported through indirect means, one of which is institutional. It involves increasing access to financial services, including overcoming barriers associated with poor people's lack of collateral, by providing either some sort of umbrella guarantee or identifying mechanisms that enable people's existing assets to act as collateral. It is therefore evident that some of the improved technology adopters have been able to have access to loans because, their credit groups or institutions have not instituted stringent conditions that will deter them from obtaining credit.

Other reasons that were advanced by this group of farmers for being satisfied with the conditions to obtain credit as displayed in Figure 7 were that members were committed in paying back loans. These farmers also stated that interest rates charged on loans were low and the duration for the repayment of loans was long. Another reason that was disclosed by some of these farmers for expressing satisfaction with the conditions attached to obtain credit was that the interest paid by group or credit union members, generated money for other members to borrow. In spite of the fact that some of the users of improved technology were satisfied with the conditions to obtain credit, 7 of the users of this technology expressed dissatisfaction with the conditions because, in their view, the interest rates charged on loans were extremely high.

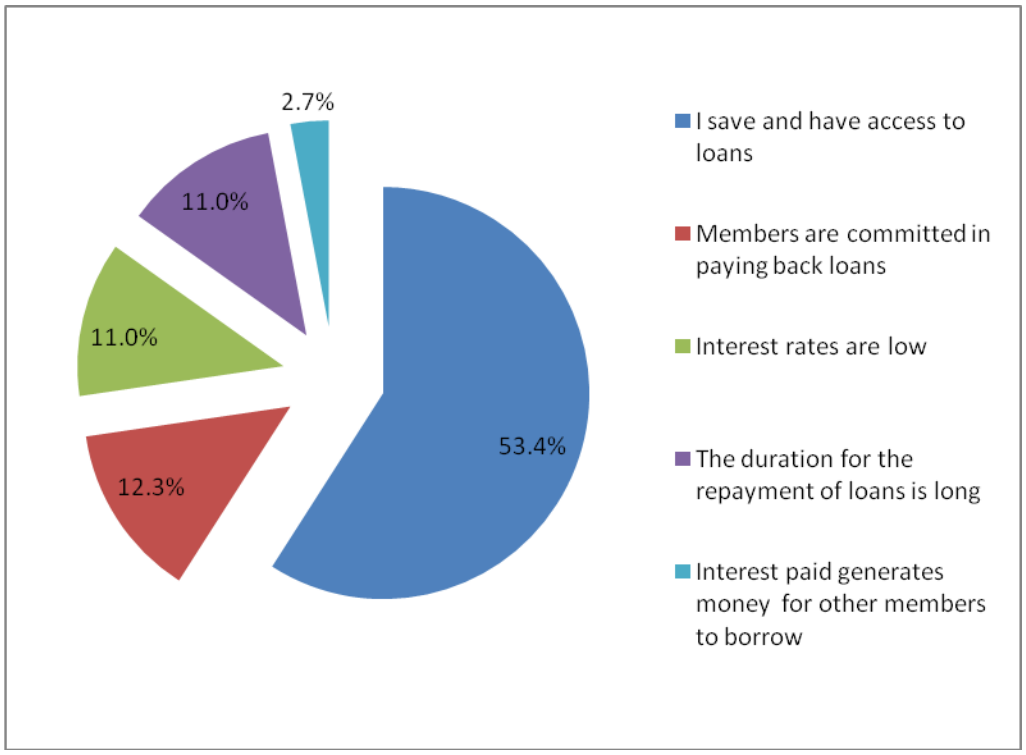

Figure 7: Reasons for farmers expressing satisfaction with the conditions attached for their procurement of credit

Source: Field data, 2009.

The reasons advanced by some farmers for not raising money from credit sources have been illustrated in Table 12. Some of the reasons stated by both groups of farmers were that interest rates were often high and they did not have money to obtain credit. Experiencing difficulties in getting a surety and the short duration given for the repayment of loans were other reasons given by farmers for not raising money from credit sources. However, the major reason that was given by 40 (65.6%) of the 61 farmers who used traditional technologies and 49 (60.5%) of their 81 counterparts who used improved technologies respectively was that interest rates were often high.

Table 12: Reasons for not raising money from credit sources

Reasons	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Interest rates are often high	40	65.6	49	60.5	89	62.7
I do not have money to obtain credit	12	19.7	21	25.9	33	23.2
Sometimes difficult to get a surety	6	9.8	6	7.4	12	8.5
Duration for the repayment of loans is short	3	4.9	5	6.2	8	5.6
Total	61	100.0	81	100.0	142	100.0

Source: Field data, 2009.

Earlier, findings from the analyses revealed that 95 (49 traditional technology respondents and 46 improved technology respondents) of the 215 respondents that were sampled for the study, used their savings in farmers or traditional groups to purchase maize technologies. Of the 95 farmers who obtained their savings to purchase technologies, 85 farmers were satisfied with the conditions to save in their farmers or traditional groups, while 10 farmers were not satisfied with the conditions. Table 13 presents the reasons disclosed by the 85 farmers for expressing satisfaction with the conditions attached to saving in their farmers' or traditional groups.

Table 13: Reasons for farmers' satisfaction with the conditions to save

Reasons	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Encouraged me to save more	29	70.7	22	50.0	51	60.0
Identified me as a group member	7	17.1	12	27.3	19	22.4
No rigid conditions attached to save	5	12.2	10	22.7	15	17.6
Total	41	100.0	44	100.0	85	100.0

Source: Field data, 2009.

The results in Table 13 show that 29 (70.7%) of the 41 respondents who used traditional technology and 22 (50%) of the 44 respondents who used improved technology expressed satisfaction with the conditions to save in their groups because, it encouraged them to save more. This confirms DFID's (1999) position that the organisational means of enabling people to have access to financial capital, increases their productivity of existing savings and financial flows, by helping to develop effective and tailored financial services for the poor, so long as they are well trusted, accessible and widely known to encourage people to save. Other reasons that were stated by both groups of farmers for being satisfied with the conditions to save were that they were not so rigid in enabling them to save and it has identified them as group members.

Though some traditional and improved technology users were satisfied with the conditions to save, the findings disclose that 10 adopters of both sets of

technologies were discontented with the conditions to save in their groups because, the registration fees charged for group membership were so high and they were so poor to pay for such fees.

Physical capital and its supporting structure

Physical capital and its supporting structure were examined in terms of the strategies used by farmers to commercialise their maize and their reasons for being satisfied and not satisfied with the farm to market roads in their communities. The results in Table 14 indicate that a total of 200 farmers cultivate maize for commercial purposes. This implies that the remaining 15 farmers do not produce maize for economic reasons. It is possible that they cultivate maize solely for domestic consumption.

Table 14: Strategies used by farmers to commercialise maize

Strategies	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Send to the market	45	88.2	120	80.5	165	82.5
Sell in front of my house	3	5.8	5	3.4	8	4.0
Sell in my farm	1	2.0	20	13.4	21	10.5
Supply to people who packet and sell seed maize	1	2.0	3	2.0	4	2.0
I hawk	1	2.0	1	0.7	2	1.0
Total	51	100.0	149	100.0	200	100.0

Source: Field data, 2009.

With regard to the strategies used by both groups of farmers to commercialise maize, the findings show that 45 (88.2%) out of the 51 farmers who used traditional maize technologies and 120 (80.5%) of the 149 farmers who used improved maize technologies send their maize to the market. This meant that the majority of farmers in the Buea sub-division commercialise their maize by sending it to the market. Others strategies used by farmers to market their maize include selling it in front of their houses, selling in their farms, hawking and supplying to people who packet and sell seed maize.

Findings from the study earlier disclosed that 165 farmers send their maize to the market for sale. Of this number of farmers, 107 expressed dissatisfaction with the road network in their communities, while 58 were satisfied with the road infrastructure in their communities. Figure 8 displays the reasons stated by farmers for being satisfied and not satisfied with the farm to market roads in their communities. The results reveal that 32 (29.9%) and 75 (70.1%) of 107 dissatisfied farmers who used traditional and improved technologies respectively, said efforts have not been made by the BSDDARD to tar the farm to market roads in their communities.

This corroborates Odabode's (2004) argument that access to a good transport infrastructure will depend on the willingness and ability of the structures and processes in place to provide them. If they do not provide transport infrastructure, then it will hinder the smooth transportation of goods and also increase the cost of transportation. In this case, farmers do not have access to a good road infrastructure, because efforts have not been made by the BSDDARD

to tar farm to market roads.

On the contrary, 13 (22.4%) and 45 (77.6%) of the 58 satisfied traditional and improved technology users respectively, asserted that efforts have been made by the BSDDARD to tar the road network in their communities.

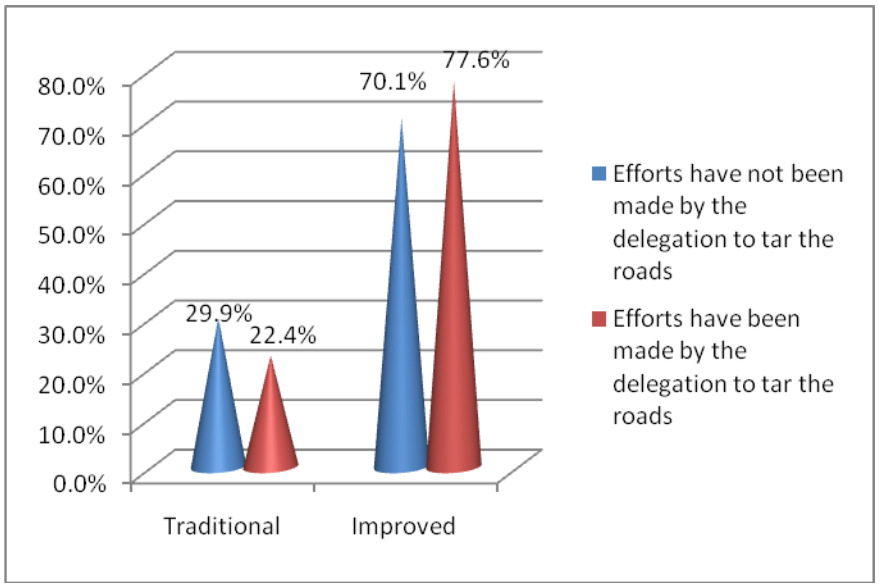

Figure 8: Reasons stated by farmers for being satisfied and not satisfied with farm to market roads

Source: Field data, 2009.

Natural capital and its supporting structures

Natural capital and its supporting structures were examined in terms of farmers' acquisition of farm land, their reasons for not possessing farm land, reasons for being satisfied and not satisfied with the conditions attached to purchase and rent farm land. In terms of farmers' acquisition of farm land, the results in Table 15 disclose that 127 farmers possessed farm land by inheriting it from their relatives, buying it from either a private individual or traditional ruler

and receiving it from a traditional ruler. About 77 (60.7%) of the 127 farmers who own farm land, inherited it from their relatives.

Table 15: Farmers' acquisition of farm land

Acquisition of farm land	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Inherited from relatives	30	81.1	47	52.2	77	60.7
Bought from a private individual	4	10.8	35	39.0	39	30.7
Given to me by a traditional ruler	2	5.4	4	4.4	6	4.7
Bought it from a traditional ruler	1	2.7	4	4.4	5	3.9
Total	37	100.0	90	100.0	127	100.0

Source: Field data, 2009.

As earlier indicated, of the 215 respondents that were sampled for the study, 127 respondents possessed farm land, while 88 respondents did not own land. As to why the 88 respondents did not possess land, the results in Table 16 reveal that land rather belonged to the husbands of 14 respondents. The findings disclose further that 60 respondents complained that buying farm land was so expensive and for this reason, they opted to rent land. Thirteen respondents also pointed out that the land they used for farming was not their personal belonging, but rather family property, while 1 respondent said the land was given to them by another farmer.

Table 16: Reasons for not possessing farm land

Reasons	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Land belongs to my husband	11	45.8	3	4.7	14	15.9
Land is so expensive, so i rent	9	37.5	51	79.7	60	68.2
It is family land	3	12.5	10	15.6	13	14.8
Land was given to me by another farmer	1	4.2	0	0.0	1	1.1
Total	24	100.0	64	100.0	88	100.0

Source: Field data, 2009.

The results disclosed that 44 of the 127 farmers, who own land, purchased it from either a private individual or traditional ruler. In this group of farmers who bought land, 41 (5 respondents of traditional technology and 36 respondents of improved technology) of them expressed satisfaction with the conditions attached to buy land, while 3 (solely respondents of improved technology) were not satisfied.

In trying to ascertain the reasons advanced by the farmers for being satisfied with the conditions attached for the purchase of farm land, the findings in Figure 9 show that 3 (30%) of the 5 farmers who used traditional technologies were satisfied with the conditions because, it fulfilled the tradition of their ethnic groups. On the other hand, 21 (91.3%) of the 36 farmers who used improved technologies were satisfied with the conditions because, they now own farm land. This suggests that land ownership is very instrumental to farmers in enabling them to derive their source of livelihoods. De Haan's (2000) asserts that natural

capital such as land is very important to those who derive all or part of their livelihoods from resource-based activities such as farming.

A reduction in the cost of farm land and paying for land at one's convenience were other reasons that were stated by the improved technology users for being satisfied with the conditions to purchase land. Though some of the traditional and improved technology adopters expressed satisfaction with the conditions to buy farm land, 3 of the adopters of improved technology were not satisfied with the conditions, as they complained that it made land more expensive.

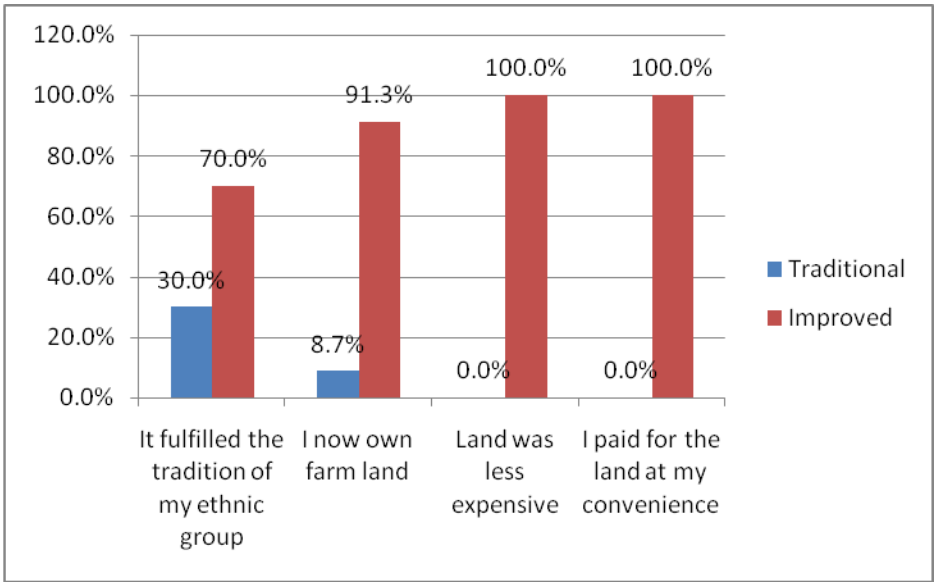

Figure 9: Reasons given by farmers for being satisfied with the conditions for the purchase of farm land

Source: Field data, 2009.

Findings from the analyses depicted that 60 of the 88 farmers who did not own land, rented land. The results reveal that 12 (4 traditional technology users and 8 improved technology users) out of the 60 technology users who rented farm

land, were not satisfied with the conditions to rent land. Three (27.3%) of the 4 users of traditional technology were not satisfied with the conditions because the rents were extremely high. Similarly, all the 8 (72.7%) respondents of improved technology were not satisfied with the conditions because the rents were so high. Only 1 (100%) farmer who used traditional technology was not satisfied with the conditions to rent land because the land could later on be sold.

On the contrary, the findings indicate further that 48 (5 adopters of traditional technology and 43 adopters of improved technology) of the 60 farmers who rented farm land were satisfied with the conditions because it made land less expensive. Thus, farmers who could either not afford to purchase land or privileged to inherit it from their relatives, could rent land. This corroborates De Haan's (2000) postulation that access to land in particular depends on it cost. When the cost of land is moderate, people tend to have more access to it and when the cost is astronomical, people tend to have limited access to it. The cost of renting land is more moderate than the cost of buying land. This has spurred some users of traditional and improved technology to rather rent than purchase farm land.

Comparisons of yields and incomes of farmers' use of traditional and improved maize technologies

Objective three of the study compared the yields and incomes of farmers who use traditional technologies to those farmers who use improve maize technologies over a three year period (2006, 2007 and 2008). The SPSS version

12 was used to conduct a normality test and ascertain whether the independent-samples t-test was appropriate for the comparison. The results revealed that the Kolmogorov-Smirnov statistic had significant values of (0.00) for farmers' yields and incomes for the three years respectively. The line on the normality plot was curved and not straight. The distribution of scores of the dependent variables (yields and incomes) for both groups of farmers on the histogram was not normally distributed.

In order to satisfy the assumptions of normality, Pallant (2001) suggested that the significant value must be greater than .05, the line on the normality plot must be straight and the distribution of scores on the histogram for two groups should be normally distributed. Since the results obtained did not satisfy these assumptions, the non- parametric alternative (Mann-Whitney non-parametric u test) of the independent sample t-test, was rather used to compare the yields and incomes of both groups of farmers. The mean yields and incomes of both groups of farmers were also reported. The yields of farmers were measured in kilograms, while the incomes were measured in the Cameroon currency (CFA).

Farmers' yields and their use of maize technologies in 2006, 2007 and 2008

Findings from the analysis in Table 17 disclose that the mean yields of farmers who use improved technologies were 7,011.987kg, 8,687.532kg and 10,991.18kg respectively, while the yields for those who use traditional technologies were 5,945.262kg, 6,824.377kg and 7,336.443kg respectively for the three years. This meant that the yields of both groups of farmers increased per

year. However, the findings depict that the yields of the improved technology adopters, were more than the yields of their counterparts who adopted traditional technologies.

Table 17: Mean yields of farmers using traditional and improved maize technologies in 2006, 2007 and 2008.

Farming technologies	N	2006 Mean (kg)	2007 Mean (kg)	2008 Mean (kg)
Improved	154	7,011.987	8,687.532	10,991.18
Traditional	61	5,945.262	6,824.377	7,336.443
Total	215			

Source: Field data, 2009.

To ascertain whether or not there were significant differences in the yields of farmers, it was hypothesised that:

H_o: There were no significant differences in the yields of farmers who use traditional and those who use improved maize technologies in 2006, 2007 and 2008.

H_1: There were significant differences in the yields of farmers who use traditional and those who use improved maize technologies in 2006, 2007 and 2008.

The results in Table 18 show that there were significant differences in the yields of both groups of farmers for each year, as the comparison yielded p-values of 0.03, 0.02 and 0.02 respectively, which were lower than the default alpha of

0.05. This meant that improved technologies led to significantly higher yields than traditional technologies over the years. The results reveal further that the differences in the yields of both groups of technology users increased overtime, since the z values were -2.098, -2.180 and -2.233 respectively for each year.

Table 18: Differences in yields between farmers using traditional and improved maize technologies in 2006, 2007 and 2008

Farming technologies	N	2006		2007		2008	
		Sig	Z	Sig	Z	Sig	Z
Traditional	61	.03	-2.098	.02	-2.180	.02	-2.233
Improved	154						
Total	215						

Source: Field data, 2009.

Thus, the results confirmed IRAD's (1994) and APCVA's (1997) findings that traditional maize technologies have yield disadvantages. The findings of IRAD's (1994) research conducted in the Central and South regions of Cameroon to test and compare the yield potentials of maize varieties revealed that traditional maize varieties produced lesser quantities of maize than improved varieties. Similarly, APCVA (1997) discovered that in a village called Ekona in the South West region of Cameroon, the usage of traditional maize inputs particularly on large farms was ineffective and produced an insignificant quantity of maize of about 2kg over 4 to 5 acres of land.

The results also corroborated IRAD's (1990) and Byerlee and Eicher (1997) assertions that improved maize technologies have yield advantages over traditional maize technologies. In a research carried out in the Meme Division in the South West region of Cameroon to ascertain the contribution of improved inputs to the yields of maize, IRAD (1990) realised that the application of improved inputs increased the yields of maize significantly, from 500 kg ha to 2000 kg ha. Similarly, in the Eastern and Southern parts of Africa, Byerlee and Eicher (1997) found that 50% to 70% of increases in maize yields were attributed to the application of improved inputs.

Farmers' incomes and their use of maize technologies in 2006, 2007 and 2008

Table 19 presents the mean incomes of both groups of farmers for the respective years.

Table 19: Mean incomes of farmers using traditional and improved maize technologies in 2006, 2007 and 2008

Farming technologies	N	2006 Mean (cfa)	2007 Mean (cfa)	2008 Mean (cfa)
Traditional	61	93,971.031	122,352.5	235,270.5
Improved	154	315,414	402,993.5	481,399.4
Total	215			

Source: Field data, 2009.

The findings depict that the mean incomes of the respondents who use traditional technologies were 93,971.31cfa, 122,352.5cfa and 235,270.5cfa, while

the respondents who use improved technologies were 315,414cfa, 402,993.5cfa and 481,399.4cfa respectively for each year. This implied that farmers' incomes increased over the years, but the incomes of farmers who use traditional technologies were less than the incomes of respondents who use improved technologies.

The incomes of respondents who use traditional technologies were compared to respondents who use improved technologies. This was done by hypothesising that:

H_o: There were no significant differences in the incomes of farmers who use traditional technologies and those who use improved technologies in 2006, 2007 and 2008.

H_1: There were significant differences in the incomes of farmers who use traditional technologies and those who use improved technologies in 2006, 2007 and 2008.

The results in Table 20 indicate that there were significant differences in the incomes of both groups of farmers, since the p-values in all the years (0.00, 0.00 and 0.00) were less than the alpha value (0.05). Essentially, farmers who used improved maize technologies had significantly higher incomes than those who used traditional maize technologies. The findings also show that the differences in the incomes of both categories of farmers increased overtime, as the z values were -5.804, -6.132 and -6.399 per year.

Thus, the results buttressed IRAD's (1990 and 1994) findings that improved maize technologies had income advantages over traditional maize

technologies. IRAD (1990) discovered in a study conducted in the South West region of Cameroon to evaluate the economic efficiency of improved maize inputs and varieties, as well as traditional maize varieties that, improved varieties and inputs had income advantages of 20% and 30% over traditional varieties.

Similarly, results from another research conducted by IRAD (1994) in the Central region of Cameroon, showed that the application of improved maize inputs gave financial benefits of 684, 380cfa (almost $1400) and 724, 060cfa (almost $1500) to farmers in the region. On the contrary, the incomes of farmers in the region decreased to 376, 515cfa (almost $800), when the improved inputs were not applied.

Table 20: Differences in the incomes of farmers using traditional and improved maize technologies in 2006, 2007 and 2008.

Farming technologies	N	2006		2007		2008	
		Sig	Z	Sig	Z	Sig	Z
Traditional	61	.00	-5.804	.00	-6.132	.00	-6.399
Improved	154						
Total	215						

Source: Field data, 2009.

Livelihood perceptions of farmers using traditional and improved maize technologies

The livelihood perceptions of farmers who use traditional technologies and their counterparts who use improved technologies were examined in terms of their abilities and inabilities to increase savings, decrease debts, access credit,

improve their provision of medication to household members, pay school fees, improve their feeding of household members, support to other family members and fulfilment of social obligations. Cross tabs were used to compare the livelihood perceptions of the different groups of farmers on an issue to issue basis over the period 2006 to 2008.

Table 21 presents the livelihood perceptions of the traditional and improved technology users in terms of their savings, provision of medical care to household members and payment of school fees in 2006. The results reveal that of the 215 farmers that were sampled for the study, only 133 (29 users of traditional technology and 104 users of improved technology) provided responses about their savings, while 82 did not provide any responses. Twenty-one (72.4%) of the 29 traditional technology respondents and only 16 (15.4%) of the 104 improved technology respondents respectively, were unable to increase their savings. There were however significant differences in the perceptions of both groups of technology users about their savings, as the p-value (0.00) was less than the requisite alpha of 0.05, with an associated χ^2 value of 38.216.

Out of the 215 respondents that were interviewed about their provision of medical care to household members, only 116 (22 adopters of traditional technology and 94 adopters of improved technology) could provide responses, while 99 could not give any information. Of the 94 improved technology adopters who gave answers, 83 (88.3%) said they were able to improve the provision of medical care to members of their household. Eight (36.4%) of 22 of their

counterparts who adopted traditional technology were also able to improve their provision of health care to household members.

Table 21: Farmers' perceptions of their savings, health care and payment of school fees in 2006

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Unable to increase savings	21	72.4	16	15.4	37	27.8
Able to increase savings	8	27.6	88	84.6	96	72.2
Total	*29*	*100.0*	*104*	*100.0*	*133*	*100.0*
Unable to improve the provision of medical care	14	63.6	11	11.7	25	21.6
Able to improve the provision of medical care	8	36.4	83	88.3	91	78.4
Total	*22*	*100.0*	*94*	*100.0*	*116*	*100.0*
Able to pay school fees	9	52.9	75	88.2	84	82.4
Unable to pay school fees	8	47.1	10	11.8	18	17.6
Total	*17*	*100.0*	*85*	*100.0*	*102*	*100.0*

Source: Field data, 2009.

Though some adopters of both sets of technologies were able to improve health care provision, there were differences in their perceptions with regard to this particular aspect of their livelihoods. This is because a comparison of the

perceptions of both groups of respondents yielded a p-value of 0.00, which was less than the default alpha of 0.05, with a χ^2 value of 32.476.

Findings from the analyses in Table 21 show further that 102 (17 farmers who used traditional technology and 85 farmers who used improved technology) out of 215 farmers, revealed their perceptions about their payment of school fees, while 113 farmers did not disclose their perceptions. The results disclosed that 75 (88.2%) out of 85 of the farmers who used improved technology were able to pay school fees for their children. Similarly, 9 (52.9%) out of the 17 farmers who used traditional technology were also able to pay their children school fees.

The results in Table 22 present farmers' perceptions of their livelihoods in terms of their feeding of household members, support to family members and fulfilment of social obligations in 2006. The findings depicted that 118 (19 users of traditional technology and 99 users of improved technology) out of the 215 interviewed technology users, provided responses about their feeding of members of their household, while 97 technology users did not provide responses. About 12 (63.2%) of the 19 traditional technology users and 92 (92.9%) of the 99 improved technology users respectively, were able to improve the feeding of members of their household.

In terms of farmers support to family members, 128 (23 traditional technology respondents and 105 improved technology respondents) of the 215 sampled farmers, provided information about this aspect their livelihoods, while 87 respondents could not divulge information. Of the 23 adopters of traditional

technology, 12 (52.2%) were not able to improve their support to family members.

Table 22: Farmers' perceptions of feeding household members, supporting family members and fulfilling social obligations in 2006

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Able to improve feeding of household members	12	63.2	92	92.9	104	88.1
Unable to improve feeding of household members	7	36.8	7	7.1	14	11.9
Total	*19*	*100.0*	*99*	*100.0*	*118*	*100.0*
Unable to improve support to family members	12	52.2	10	9.5	22	17.2
Able to improve support to family members	11	47.8	95	90.5	106	82.8
Total	*23*	*100.0*	*105*	*100.0*	*128*	*100.0*
Unable to improve fulfilment of social obligations	14	56.0	6	5.9	20	15.9
Able to improve fulfilment of social obligations	11	44.0	95	94.1	106	84.1
Total	*25*	*100.0*	*101*	*100.0*	*126*	*100.0*

Source: Field data, 2009

Similarly, 10 (9.5%) out of the 105 improved technology adopters were unable to improve their support to members of their family. The perceptions of both groups of farmers about their support to family members were however different, since the cross tab analysis gave a p-value of 0.00, which was smaller than 0.05 and a χ^2 statistic of 34.335.

Of the 215 farmers that were interviewed, 126 (25 traditional technology adopters and 101 improved technology adopters) gave responses about their perceptions of their fulfilment of social obligations, while 89 did not provide responses. The findings in Table 22 indicate that 95 (94.1%) of the 101 adopters of improved technology and 11 (44%) of the 25 adopters of traditional technology respectively, were able to improve their fulfilment of social obligations. However, the results depicted that the p-value (0.00) < 0.05, with an associated χ^2 value of 40.332. This meant that though some users of both sets of technologies were able to improve their fulfilment of social obligations, they however differed in their perceptions on this aspect of their livelihoods.

A total of 112 (18 farmers who used traditional technology and 94 farmers who used improved technology) out of 215 farmers provided information about their debt situation, while 103 technology users did not provide responses. Findings from the analysis indicated that all the 18 farmers who used traditional technologies were unable to pay their debts. Similarly, 15 (16%) of 94 of their counterparts who used improved technology were not able to pay their debts. In terms of farmers access to credit, 104 (17 traditional technology adopters and 87 improved technology adopters) out of 215 technology respondents provided

responses on this issue, while 111 technology adopters did not provide any responses. The results showed that all the 17 farmers who used traditional technology and 7 of their 87 counterparts who used improved technology respectively, were not able to access credit.

From the foregoing discussions, it is evident that the improved technology users had better perceptions of their livelihoods than their counterparts who used traditional technologies in 2006. This confirms the arguments raised in the DFID livelihood framework (1999) and conceptual framework (2009) that farmers who adopt traditional technologies may be unable to fulfil their livelihood outcomes satisfactorily, while farmers who adopt improved technologies may be able to satisfy their livelihood expectations well.

Table 23 examines the livelihood perceptions of both groups of farmers in 2007 with regard to their savings, debt situations, provision of medication and payment of school fees. The results depict that only 154 (32 traditional technology respondents and 122 improved technology respondents) of the 215 sampled farmers provided information about their savings, while 61 technology users did not provide any responses.

Of the 32 traditional technology respondents, 19 (59.4%) were unable to increase their savings. This was a similar situation with 24 (19.7%) of the 122 improved technology counterparts who were also not able to increase their savings. The results however showed that there were significant differences in the perceptions of the two groups of technology respondents with regards to their ability to increase savings, as the p- value (0.00) < 0.05 and the χ^2 statistic was

31.482. Ninety-eight (80.3%) of the adopters of improved technology were able to increase their savings, relative to only 13 (40.6%) of their traditional technology counterparts were also able to increase their savings.

Table 23: Farmers' perceptions of their savings, debts, provision of medication and payment of school fees in 2007

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Unable to increase savings	19	59.4	24	19.7	43	27.9
Able to increase savings	13	40.6	98	80.3	111	72.1
Total	*32*	*100.0*	*122*	*100.0*	*154*	*100.0*
Able to pay debts	10	47.6	89	80.2	99	75.0
Unable to pay debts	11	52.4	22	19.8	33	25.0
Total	*21*	*100.0*	*111*	*100.0*	*132*	*100.0*
Unable to improve the provision of medical care	20	66.7	15	12.5	35	23.3
Able to improve the provision of medical care	10	33.3	105	87.5	115	76.7
Total	*30*	*100.0*	*120*	*100.0*	*150*	*100.0*
Able to pay school fees	11	61.1	106	91.4	117	87.3
Unable to pay school fees	7	38.9	10	8.6	17	12.7
Total	*18*	*100.0*	*116*	*100.0*	*134*	*100.0*

Source: Field data, 2009.

The findings disclosed further that out of the 215 farmers, 132 (21 farmers who used traditional technology and 111 farmers who used improved technology) provided responses with regard to their debt situations, while 83 did not provide answers on the issue. Eighty-nine (80.2%) out of the 111 farmers who used improved technology and 10 (47.6%) of the 21 farmers who used traditional technology respectively, were able to pay their debts. However, the perceptions of both groups of farmers differed, as the results yielded a χ^2 statistic of 32.707, with a p-value of 0.00, which was smaller than the requisite alpha value of 0.05.

Of the 215 respondents who were interviewed, 150 (30 traditional technology adopters and 120 improved technology adopters) provided answers about their provision of medication to members of their household, while 65 did not provide any answers. Findings from the analysis depicted that 20 (66.7%) of the 30 respondents who adopted traditional technology and 15 (12.5%) of their counterparts who adopted improved technology respectively, were not able to improve their provision of health care to members of their household. The perceptions between the two groups of respondents differed, as the p-value (0.00) was less than 0.05, with a χ^2 value of 48.104.

Out of the 215 sampled technology users, 134 (18 users of traditional technology and 116 users of improved technology) provided responses about their perceptions on the payment of school fees, while 81 did not provide any information. The analyses showed that 11 (61.6%) of the 18 traditional technology users were able to pay school fees for their children. Similarly, 106

(91.4%) of their 116 counterparts who used improved technology were also able to pay their children school fees.

Table 24 illustrates the results of farmers' perceptions of their livelihoods in terms of their feeding of household members, support to family members and fulfilment of social obligations in 2007. The analyses disclosed that 139 (22 adopters of traditional technology and 117 adopters of improved technology) out of the 215 sampled respondents provide information about their feeding of household members, while 76 technology adopters did not provide any responses.

Twelve (54.5%) of the 22 adopters of traditional technology were unable to improve their feeding of household members. In the same vain, 11 (9.4%) of the 117 respondents who adopted improved technology were not able to improve their feeding of members of their household. The results revealed further that the p-value (0.00) < 0.05, while the associated χ^2 value was 48.366. This indicated that there were significant differences in the perceptions of both groups of technology adopters, concerning their feeding of household members.

With regard to farmers support to family members, 128 (19 farmers who used traditional technology and 109 farmers who used improved technology) of the 215 interviewed farmers gave responses on this issue, while 87 farmers did not provide any responses. The findings showed that 13 (88.4%) of the 19 farmers who used traditional technology and 94 (86.2%) of the 109 farmers who used improved technology respectively, were both able to improve their support to family members.

Table 24: Farmers' perceptions of their feeding of household members, support to family members and fulfilment of social obligations in 2007

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Able to improve the feeding of household members	10	45.5	106	90.6	116	83.5
Unable to improve the feeding of household members	12	54.5	11	9.4	23	16.5
Total	*22*	*100.0*	*117*	*100.0*	*139*	*100.0*
Able to improve support to family members	13	88.4	94	86.2	107	83.6
Unable to improve support to family members	6	31.6	15	13.8	21	16.4
Total	*19*	*100.0*	*109*	*100.0*	*128*	*100.0*
Unable to improve fulfilment of social obligations	17	65.4	11	9.8	28	20.3
Able to improve fulfilment of social obligations	9	34.6	101	90.2	110	79.7
Total	*26*	*100.0*	*112*	*100.0*	*138*	*100.0*

Source: Field data, 2009.

The results in Table 24 reveal further that 138 (26 traditional technology respondents and 112 improved technology respondents) of the 215 farmers

disclosed their perceptions about their fulfilment of social obligations, while 77 farmers did not disclose their perceptions. Seventeen (65.4%) out of the 26 respondents of traditional technology were unable to improve their fulfilment of social obligations. This was a similar situation with 11 (9.8%) out of the 112 improved technology respondents who were also not able to improve their fulfilment of social obligations. These similarities did not reflect in farmers' perceptions, as they expressed different views on their fulfilment of social obligations. This was evident with a p- value of 0.00, which was smaller than 0.05 and a χ^2 value of 47.533.

The findings showed further that 120 (106 improved technology adopters and 14 adopters of traditional technology) out of the 215 farmers that were sampled for the study provided responses about their access to credit, while 95 technology adopters did not provide any answers. All the 14 adopters of traditional technology were unable to access credit. Similarly, 17 of their 106 counterparts who adopted improved technology were also not able to have access to credit.

Thus, the results indicate that the respondents who used improved technologies had better perceptions of their livelihoods, than the respondents who used traditional technologies in 2007. The findings buttresses the assertions made in the DFID livelihood framework (1999) and conceptual framework (2009) that farmers who adopt improved technologies may experience better livelihoods, than farmers who adopt traditional maize technologies.

Table 25 displays the findings of the livelihood perceptions of both groups of farmers with regard to their savings, provision of medical care and payment of children school fees in 2008. Results from the analysis disclose that 164 (36 respondents of traditional technology and 128 respondents of improved technology) out of the 215 sampled technology users provided responses about their savings, while 51 respondents could not give their perceptions about this aspect of their livelihoods. Of the 128 improved technology users, 21 (16.4%) were not able to increase their savings. This was also the case with 26 (72.2%) of the 36 users of traditional technology who were also unable to increase their savings. The results showed that the perceptions of both groups of technology respondents were different, as the p-value (0.00) < 0.05, with an associated χ^2 statistic of 50.120.

In terms of farmers provision of medication to members of their household, 140 (24 traditional technology adopters and 116 improved technology adopters) of the 215 interviewed technology adopters provided answers about this aspect of their livelihoods, while 75 farmers did not provide any information. Out of the 24 farmers who adopted traditional technology, 10 (41.7%) were able to improve their provision of medical care to household members. About 98 (84.5%) of the 116 adopters of improved technology were also able to improve their provision of health care to members of their household. However, the perceptions of the two groups of technology users varied, as the cross tab analysis yielded a p-value of 0.00, less than 0.05, with a χ^2 value of 70.339.

Table 25: Farmers' perceptions of savings, provision of health care and payment of school fees in 2008

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Unable to increase savings	26	72.2	21	16.4	47	28.7
Able to increase savings	10	27.8	107	83.6	117	71.3
Total	*36*	*100.0*	*128*	*100.0*	*164*	*100.0*
Unable to improve the provision of medical care	14	58.3	18	15.5	32	22.9
Able to improve the provision of medical care	10	41.7	98	84.5	108	77.1
Total	*24*	*100.0*	*116*	*100.0*	*140*	*100.0*
Able to pay school fees	11	50.0	108	93.9	119	86.9
Unable to pay school fees	11	50.0	7	6.1	18	13.1
Total	*22*	*100.0*	*115*	*100.0*	*137*	*100.0*

Source: Field data, 2009.

One hundred and thirty-seven (115 users of improved technology and 22 users of traditional technology) out of 215 farmers provided responses about their payment of children school fees, while 78 farmers did not provide any responses. The findings revealed that 11 (50%) of the 22 traditional technology users and 108 (93.9%) of the 115 users of improved technology respectively, were able to pay their children school fees.

Table 26 presents farmers' perceptions of their livelihoods in terms of their feeding of household members, support to members of their family and fulfilment of social obligations in 2008. The analyses indicated that 158 (34 farmers who used traditional technology and 124 farmers who used improved technology) of the 215 respondents, provided information about their feeding of members of their household, while 57 respondents did not provide any responses.

The results disclosed that 15 (12.1%) out of the 124 farmers who used improved technology were unable to improve their feeding of household members. In the same vain, 21 (61.8%) of the 34 farmers who used traditional technology, were also not able to improve their feeding of members of their household. However, these similarities did not reflect in the perceptions of farmers on this aspect of their livelihoods, since they expressed different views. This was evident with a p-value of 0.00, which was smaller than the requisite alpha value of 0.05 and an associated χ^2 statistic of 44.866.

The findings also indicated that 143 (118 farmers who used improved technology and 25 farmers who used traditional technology) out of the 215 technology respondents who were sampled for the study, provided answers about their support to family members, while 72 technology users did not provide any responses. The results in Table 26 show further that out of the 25 farmers who adopted traditional technology, 11 (44%) were able to improve their support to members of their family. This was a similar situation with 105 (89%) of their 118 counterparts who adopted improved technology. The views between the two

groups of farmers about their support to family members varied, as the p-value (0.00) was less than the default alpha of 0.05, with a χ^2 value of 44.264.

Table 26: Farmers' perceptions of their feeding of household members, support to family members and fulfilment of social obligations in 2008

Livelihood perceptions	Traditional		Improved		Total	
	Freq.	%	Freq.	%	Freq.	%
Able to improve feeding of household members	13	38.2	109	87.9	122	77.2
Unable to improve feeding of household members	21	61.8	15	12.1	36	22.8
Total	*34*	*100.0*	*124*	*100.0*	*158*	*100.0*
Unable to improve support to family members	14	56.0	13	11.0	27	18.9
Able to improve support to family members	11	44.0	105	89.0	116	81.1
Total	*25*	*100.0*	*118*	*100.0*	*143*	*100.0*
Unable to improve the fulfilment of social obligations	16	66.7	16	13.1	32	21.9
Able to improve the fulfilment of social obligations	8	33.3	106	66.9	114	78.1
Total	*24*	*100.0*	*122*	*100.0*	*146*	*100.0*

Source: Field data, 2009.

Out of the 215 sampled respondents, 146 (24 traditional technology respondents and 122 improved technology respondents) gave their perceptions about their fulfilment of social obligations, while 69 farmers were unable to give their perceptions. Results from the analysis showed that 16 (66.7%) out of the 24 respondents of traditional technology were unable to improve their fulfilment of social obligations. This was the case with 16 (13.1%) of the 122 improved technology respondents who were also unable to improve their fulfilment of social obligations. However, there were significant differences in the views of both groups of technology respondents on this issue of their livelihoods, since the χ^2 value was 54.595, with an associated p-value of 0.00, smaller than the alpha value of 0.05.

In terms of farmers payment of debts, the findings disclosed that 136 (26 traditional technology adopters and 110 adopters of improved technology) of the 215 adopters provided information about this indicator of their livelihoods, while 79 technology adopters did not provide any answers. The results revealed that all the 26 adopters of traditional technology were unable to pay their debts. In the same vain, 16 (14.5%) of their 110 counterparts who adopted improved technology were also not able to pay their debts.

With regard to the respondents access to credit, 121 (104 users of improved technology and 17 traditional technology users) of the 215 technology users provided responses about this aspect of their livelihoods, while 94 users were unable to provide responses. About 18 (17.3%) out of the 104 users of

improved technology and all the 17 traditional technology users respectively, were not able to access credit.

In a nutshell, the results for 2008 showed that farmers using the improved technologies as in the previous years, perceived their livelihoods as better in terms of their ability to increase savings, pay debts, access credit, improve the provision of medication to household members. They also viewed their livelihoods to be better than their counterparts who used traditional technologies with regard to their payment of children school fees, improvement in their feeding of members of their household, support to family members and fulfilment of social obligations.

Essentially, the analyses of farmers' livelihood perceptions from 2006 to 2008 show that farmers who used improved maize technologies had better perceptions of their livelihoods than their counterparts who used traditional technologies. This espouses the postulations in the DFID livelihood framework (1999) and conceptual framework (2009) that farmers who adopt traditional maize technologies are less likely to experience satisfactory livelihood outcomes than farmers who adopt improved technologies.

The roles played by extension officers in enabling farmers to adopt and diffuse maize technologies

Objective five of the study examined the role played by extension officers in enabling farmers to adopt and diffuse maize technologies. The issues that were covered included the languages and methods of communication to farmers about

innovations on maize technologies, the attitude of farmers towards innovations, the methods used in training farmers to adopt and diffuse maize technologies and the relationship that exist between extension officers, opinion leaders and farmers. Pie charts were used to analyse and present these roles.

In the analyses conducted, the results disclosed that extension officers use English, Pidgin (Broken English) and the local language (Bakweri) to communicate to farmers, when training them to adopt maize innovations. However, the languages of communication that are often used by the extension agents in their training sessions are English and Pidgin, since most of the farmers in the Buea sub-division are not indigenes of the sub-division and are unable to speak the Bakweri language. For this reason, 2 (50.0%) out of 4 extensionists spoke Pidgin, while another 2 (50.0%) out of 4 extension officers spoke English during their training sessions because, these were the languages best understood by most of the farmers.

Findings also show that during training sessions, extension agents used field demonstrations, on-the spot training, lectures on a weekly basis and advised farmers on what to do whenever they faced difficulties, as their methods of communicating to farmers about innovations. However, 2 (50.0%) out of 4 officers used solely field demonstrations to train farmers on maize innovations because, this was the method of communication best understood by them.

The results, as shown in Figure 10, indicate that some farmers reacted positively, while other farmers reacted negatively to innovations. Only 2 (50.0%) extension officers said farmers in their groups adopted maize innovations

immediately they heard about it. One (25.0%) of the extensionists disclosed that some farmers were fast to adopt innovations, while others were slow to adopt innovations because they often wanted to see their outcomes, before they could be sure of adopting them. Another one (25.0%) of the extension agents revealed that some farmers adopted innovations immediately, while others resisted innovations because they often demonstrated uncertainty about them.

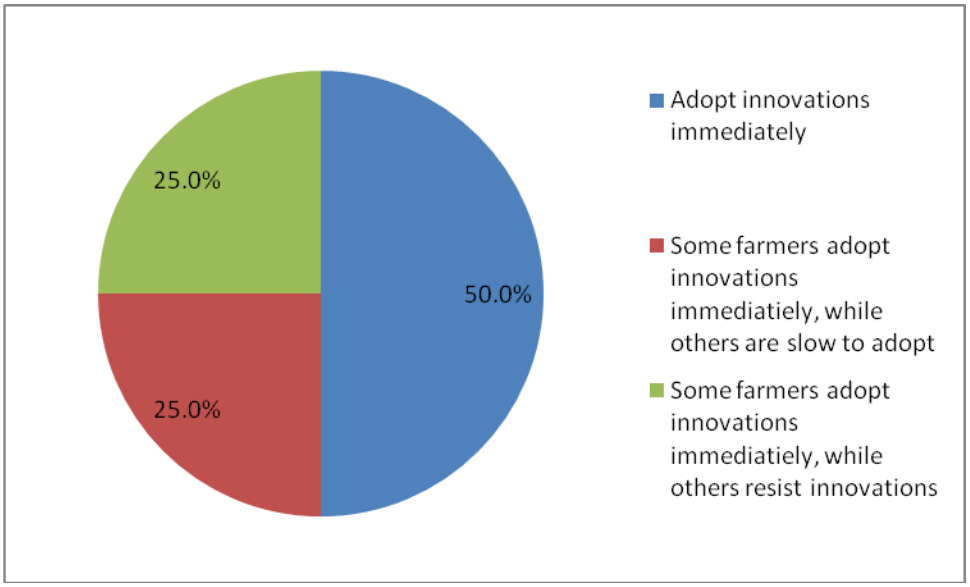

Figure 10: Extension officers' perceptions of farmers' attitudes towards innovations

Source: Field data, 2009.

However, the officers pointed out that they enabled farmers who were either slow to adopt or resisted innovations in building a positive attitude by continuously educating them, encouraging them to adopt innovations and monitoring their individual farms. The findings buttresses Van De Ban and Hawkins's (1988) admonition that extensionists could build a positive attitude

towards an innovation by paying field days and farm visits to the farms of individual farmers, to enable them to see what they have been hearing or listening to in lectures. This will provide them with an opportunity to build the desired attitude towards an innovation.

Results from the analysis in Figures 11 and 12 show the methods used by extension officers in training farmers to adopt and diffuse maize technologies. The findings depicted that 2 (50.0%) out of 4 officers carried out field demonstrations with farmers who had similar farm experiences. Another 2 (50.0%) out of the 4 officers organised meetings to share ideas with farmers.

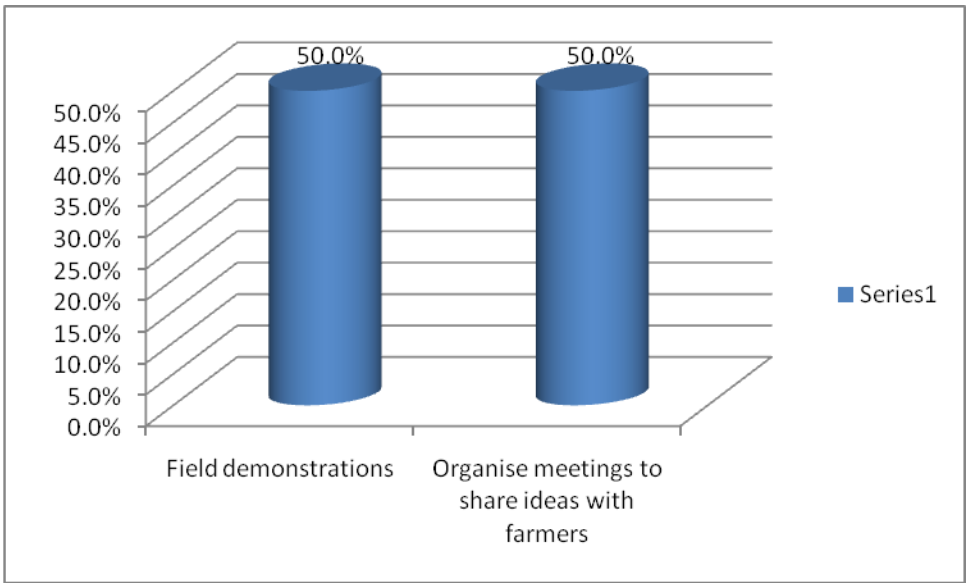

Figure 11: Methods of training farmers with similar farm experiences.

Source: Field data, 2009.

As to how the officers treat farmers with different farm experiences, the analyses in Figure 12 disclose that 2 (50.0%) out of the 4 officers organised exchange visits for farmers to exchange ideas among themselves. This espouses Swanson et al.'s (1997) caution that farmers' exchange should be organised for

farmers with different farm experiences. This will bring together farmers who are already further advanced in an adoption process and those who just began the adoption of innovations to share ideas. These types of experiences allow for the removal of doubts.

The findings show further that 1 (25.0%) of the officers used a participatory approach in discussing pertinent issues with farmers, while another 1(25.0%) extension agent dealt with every problem in a group of many farmers for other farmers to benefit, as their strategies in dealing with farmers with different farm experiences. All the 4 (100%) extensionists helped farmers to diffuse maize technologies by inviting other farmers who do not belong to groups to join field demonstrations.

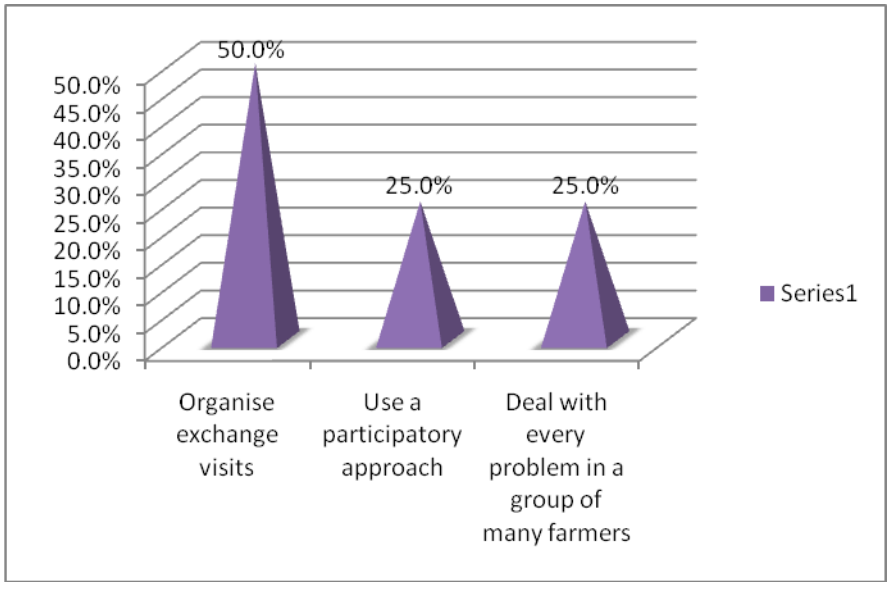

Figure 12: Methods of training farmers with different farm experiences.

Source: Field data, 2009.

The results revealed that extension agents relate with opinion leaders and several factions of farmers in their respective communities, in order to influence

other farmers to adopt innovations. All the four extension officers used different strategies to relate with opinion leaders on maize innovations in their communities of jurisdiction. This conforms to Rogers's (1983) caution that the extension agents should try to relate with opinion leaders, in order to gain their trust and develop their interest in modernising agriculture, so that they can in turn influence other farmers.

The strategies used by extension officers to relate with opinion leaders are shown in Figure 13. One (25.0%) of the officers listened to the opinions of leaders and adopted them if they were found good. Another officer (25.0%) carried out field demonstrations on the farms of opinion leaders.

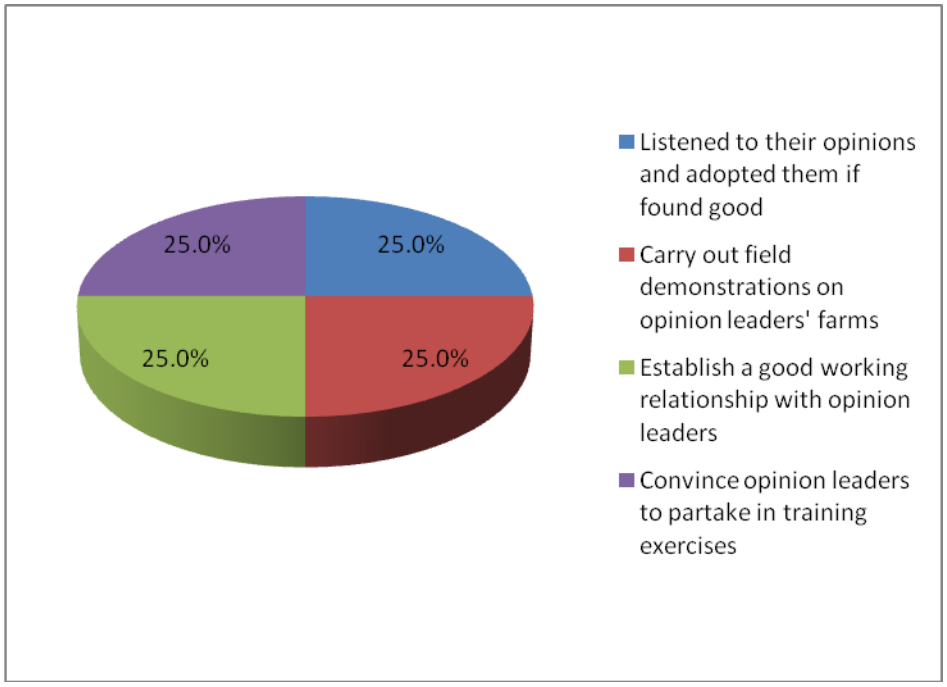

Figure 13: Strategies used by extension officers to relate with opinion leaders

Source: Field data, 2009.

The findings therefore corroborate the suggestions made by Van De Ban and Hawkins's (1988) that an extension agent can point out that a demonstration will be more effective, if it is held on an opinion leader's farm and then seek suggestions about where it can be held. The results also show that the two of the officers established a good working relationship with opinion leaders (25.0%) and convinced them to partake in training exercises (25.0%) respectively.

Results from the analyses showed further that 2 (50.0%) of the 4 officers related with all the factions of farmers in their communities, by establishing good working relationships with each faction. This supports Rogers's (1983) position that extension agents should try to cooperate with all factions of farmers in a community. The other 2 (50.0%) officers did not relate with all the factions of farmers in their communities because, some farmers did not belong to groups, while others did not care about innovations.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary, conclusions and recommendations.

Summary

The study set out to examine farmers' perceptions of the contribution of maize farming technologies to their livelihoods. The research design used for the study was the ex post facto design. The research covered 215 farmers and all the four extension officers were randomly selected in the sub-division.

The main findings of the study are as follows:

- The sex of farmers did not influence their use of maize technologies.
- Farmers' age groups did not influence their usage of maize technologies.
- The educational level of farmers did not influence their adoption of maize technologies.
- The majority of farmers who used traditional maize technologies, said the technologies were less costly than improved maize technologies, while many of their counterparts who used improved technologies said the technologies

enabled them to have access to the markets than traditional technologies.

- More of the users of traditional technologies were trained by their parents because, they did not have money to attend training sessions organised by extension officers, while many of the respondents who used improved technologies were trained by extension officers and were satisfied with the training given to them because, it enabled them to increase their yields.
- Most of the respondents who used traditional technologies did not belong to groups because they considered them to be unreliable, while more of the farmers who used improved technologies belonged to groups and were satisfied with the conditions attached for group membership because their money was secured in their groups.
- Many of the traditional technology users raised money from savings obtained from their farmers' or traditional groups for their farming operations, while most of the improved technology users raised money from credit obtained from their farmers' groups or credit unions.
- The majority of traditional technology users could not raise money from formal credit sources because the interest rates charged on credit were often high. On the contrary, the improved technology users were satisfied with the conditions attached for their procurement of credit from farmers' groups or credit unions because they could save and have access to loans.
- Most of the farmers from both groups were not satisfied with the farm to market roads in their communities because of the poor nature of the roads and efforts had not been made by the BSDDARD to tar the roads.

- Many of the respondents who used traditional technologies and those who used improved technologies possessed farm land by inheritance. However, few of the respondents from both groups did not possess farm land because it belonged to their husbands and was so expensive that they opted to rent respectively.
- There were significant differences between the yields of farmers who used traditional technologies and those who used improved maize technologies in 2006, 2007 and 2008. This meant that farmers who used improved technologies had higher yields consecutively for the three years than farmers who used traditional technologies.
- There were also significant differences between the incomes of farmers who used traditional technologies and their counterparts who used improved technologies in 2006, 2007 and 2008. This implied that farmers who adopted improved technologies had better incomes consistently for three years than their counterparts who adopted traditional technologies.
- The improved technology users had better perceptions of their livelihoods than the traditional technology users in 2006. Comparatively, the users of improved technology could increase their savings, pay debts, have access to credit, provide medical care to members of their household, feed household members, support family members and fulfil their social obligations better than the users of traditional technology.
- The respondents for improved maize technology had better livelihood perceptions than the respondents for traditional maize technology in 2007.

Similarly, the improved technology respondents could satisfy the said aspects of their livelihoods better than the traditional technology respondents.

- Farmers who adopted improved maize technologies had better perceptions of their livelihoods than their counterparts who used traditional maize technologies in 2008. This meant that the adopters of improved technology could fulfil their said livelihood expectations better than the traditional technology adopters.
- The extension officers used languages that were understandable to the farmers to communicate, when training them to adopt maize innovations. They also used solely field demonstrations, as their method of communication to farmers.
- Some of the officers continuously educated farmers, encouraged them to adopt innovations and monitored their individual farms, when they were slow to adopt and resisted innovations.
- The extension officers carried out field demonstrations and organised meetings to share ideas with farmers who had farm experiences that were similar. They also organised exchange visits for farmers with different farm experiences.
- All four extension officers invited farmers who did not belong to groups to join field demonstrations, as a strategy to diffuse maize technologies.
- All the four extension agents established relationships with opinion leaders in their communities. Two out of the four officers, established relationships with all factions of farmers in their communities. The other two officers did not

establish relationships with all factions of farmers in their communities of jurisdiction because some of them did not belong to groups or did not care about innovations.

Conclusions

Farmers' demographic characteristics did not influence their use of maize technologies. This meant that sex, age and educational levels did not influence the adoption of maize technologies (traditional or improved). Therefore, these characteristics did not affect their interest in the adoption of maize technologies.

The low cost of traditional technologies, the absence of funds to attend training sessions organised by extension officers, unreliability of farmers' groups, high interest rates charged on credit and the deplorable road infrastructure in the farming communities, were the views given by traditional technology users for using their said technologies. On the contrary, access to the markets, access to the services of extension officers whose training has increased the yields of improved technology users, membership in groups where farmers' money is secured, ability to save and have access to credit in a farmers' group or credit union, were the views canvassed by farmers who used improved technologies for adopting their selected technologies.

There were significant differences in the yields and incomes of farmers who use traditional maize technologies and those who use improved maize technologies in 2006, 2007 and 2008. The improved technology users significantly, had higher yields and incomes than their counterparts who use

traditional technologies for the three years. Therefore, improved maize technologies contributed to higher yields and incomes than traditional maize technologies.

Farmers who use improved maize technologies had better perceptions of their livelihoods than farmers who use traditional maize technologies in 2006, 2007 and 2008. Comparatively, farmers who use improve technologies could increase their savings, pay debts, have access to credit, provide medical care to members of their household, feed household members, support family members and fulfil their social obligations, better than their counterparts who use traditional technologies for the three years.

Extension officers train farmers to adopt and diffuse maize technologies by using the languages and methods of communication best understood by the farmers, educating, encouraging and monitoring farmers who are slow to adopt and resist innovations. The officers also carry out field demonstrations and share ideas with farmers who have similar farm experiences, organise exchange visits for farmers with different farm experiences, invite farmers who do not belong to groups to join field demonstrations and establish relationships with opinion leaders and all factions of farmers in their communities.

The affordability of maize technologies, access to the markets, access to human, social, financial, physical and natural capitals, as shown in the conceptual framework (Figure 2), influences farmers' adoption of improved maize technologies. The roles played by the extension officers, farmers' groups, Delegation of Agriculture and Rural Development and credit unions, enables

farmers to have access to human, social, physical, financial and natural capitals. When farmers have access to these capitals and adopt improved maize technologies they will have better perceptions of their livelihoods.

Recommendations

Based on the findings and conclusions of the study, farmers are encouraged to:

- Press for a subsidy of improved maize farm inputs and varieties. This would reduce the cost of improved maize technologies and pave the way for more farmers to adopt the said technologies. It would also enable them to have access to the markets.
- Seek for a reduction in the cost of attending training sessions organised by extension officers. This would encourage more farmers, especially those who use traditional maize technologies to get trained by extension officers.
- Educate their colleagues who do not attend training sessions, on the need and benefits to be derived in investing in themselves. This may persuade them in developing the willingness to pay for and attend training sessions.
- Educate farmers who do not belong to groups on the need and benefits to be derived in joining a group. This would encourage more farmers to join groups and have access to the services of extension officers, since they reach out to farmers through groups.
- Petition their groups for a reduction in the interest rates charged on credit. If this is done, more farmers would be encouraged to raise money from credit

sources and top up their savings to purchase improved maize technologies.

- Pressurise the BSDDARD to tar farm to market roads in their communities. This would ease the transportation of maize to the market. A good road infrastructure in the sub-division would also curtail the cost of transportation, as well as the price of maize in the market and encourage more people to buy maize.

From the major findings and conclusions derived from the study, extension agents are advised to:

- Encourage more farmers to join groups, as this would ease their out reach to them. This can be done by educating and sensitising farmers who do not belong to groups through the media, especially through the radio and local vans which are common means of communication in farming communities. In using these means of communication, the officers need to educate farmers on the need and the benefits to be derived in belonging to a group.
- Educate and sensitise farmers who do not care about innovations. This can be done by using the radio and local vans to inform farmers about maize innovations and invite them to join field demonstrations with other farmers. If this is done, farmers who are not interested in innovations would also see what they have heard about maize innovations. This would encourage them to adopt the innovations.
- Make it their duty to visit farmers' maize farms regularly, continuously encourage and educate farmers about innovations. The officers should amplify their efforts by organising exchange visits for farmers who do not care about

innovations, to bring them in contact with other farmers who are already far advanced in the adoption of maize innovations. Through such visits, farmers can confer farm experiences and learn from one another.

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APPENDIX 1

STRUCTURED INTERVIEW SCHEDULE FOR MAIZE FARMERS

Dear Respondent,

I am a Master of Philosophy student in the Institute for Development Studies at the University of Cape Coast in Ghana. This is a study to examine farmers' perceptions of the contribution of maize farming technologies to livelihoods in the Buea sub-division of Cameroon. The quest for information is principally for academic purposes. Responses provided shall be treated confidentially and uniquely for the stated purpose. Please be candid in expressing your opinions closest to the way you feel about an issue.

THANK YOU

PART ONE

Demographic characteristics of farmers and their usage of maize farming technologies

1. Sex:

a) Male ☐ b) Female ☐

2. Indicate your age at your last birthday (in years): _____

3. Educational level:

a) No formal schooling/education ☐

b) First School Leaving Certificate and below ☐ d) G.C.E Advanced Level ☐

c). G.C.E Ordinary Level ☐ e) Graduate ☐

f) Others (specify) _____

4. Which farm inputs have you used from 2006 to 2008 to cultivate maize?

a) Organic manures ☐ c) Herbicides ☐

b) Wood ash and kerosene mixture ☐ d) Inorganic fertilizers ☐

e) Insecticides ☐

5. Which maize seedlings have you used from 2006 to 2008?

a) Local white type of maize ☐ d) Others (specify) _____

b) Improved white maize ☐

c) Improved yellow maize ☐

PART TWO

Farmers' views of other factors that influence their usage of maize technologies

6. Why are you using your selected farm inputs and seedlings?

a) It is less expensive ☐

b) I find it easy to understand them ☐

c) It is my traditional way of cultivating maize ☐

d) I will have access to the markets ☐

e) I have been influenced by the results of these inputs used by other farmers ☐

f) Others (specify) _____

7. How did you obtain your skills to cultivate maize?

a) From my parents ☐

c) From an extension officer ☐

d) Others (specify) _____

8. If your skills were obtained from an extension officer, does he or she visit your farm?

a) Yes ☐ b) No ☐

9. If yes, how often does he ore she visit your farm?

a) Once a week ☐ d) Once in four weeks ☐

b) Once in two weeks ☐ e) Once in five weeks ☐

c) Once in three weeks ☐ f) Three or four times a month ☐

g) Others (specify) _____

10. If no, why? _____

11. If an extension officer visits your farm, how does he or she train you?

_____

_____

12. Are you satisfied with his or her training?

a) Yes ☐ b) No ☐

13. If yes or no, why? _____

14. If you were trained by your parents, why?

_____

15. Are you a member of any farmers' group?

a) Yes ☐ b) No ☐

16. If yes, are there any conditions you must fulfil to became a member of the group?

a) Yes ☐ b) No ☐

17. If yes, what are the conditions to become a member? _____

18. Are you satisfied with the conditions?

a) Yes ☐ b) No ☐

19. If yes or no, why? _____

20. If you are not a member of any farmers' group, why?

_____

21. How do you raise money to purchase your farm inputs and maize seedlings?

a) I obtain credit from my farmers' group or credit union ☐

b) Savings from farmers or traditional groups ☐

c) From relatives ☐

d) From friends ☐

e) Others (specify) _____

22. If you obtain credit from a farmers' group or credit union, are there any conditions you must fulfil to obtain it?

a. Yes ☐ b) No ☐

23. If yes, what are the conditions? _____

24. Are you satisfied with the conditions?

a) Yes ☐ b) No ☐

25. If yes or no, why? _____

26. If you do not raise money from credit sources, why?

_____

27. If you save with a farmers' or traditional group, are there any conditions attached to save?

a) Yes ☐ b) No ☐

28. If yes, what are the conditions? _____

29. Are you satisfied with the conditions?

a) Yes ☐ b) No ☐

30. If yes or no, why? _____

31. Do you sell your maize?

a) Yes ☐ b) No ☐

32. If yes, how do you sell them?

a) I hawk them ☐ c) I supply to people who packet and sell the seed maize ☐

b) I send them to the market ☐ d) I sell them on the spot ☐

e) I sell in front of my house ☐

33. Are you satisfied with the farm to market roads in your community?

a) Yes ☐ b) No ☐

34. If yes or no why? _____

35. Do you own farm land to cultivate maize?

a) Yes ☐ b) No ☐

36. If yes, how did you acquire it?

a) I inherited it from my parents or relatives ☐

b) I bought it from a traditional ruler ☐

c) It was given to me by a traditional ruler ☐

d) I bought it from a private individual ☐

37. If no, why? _____

38. If you bought land from a private individual or traditional ruler, were there any conditions attached to buy it?

a) Yes ☐ b) No ☐

39. If yes, what were the conditions? _____

40. Were you satisfied with the conditions?

a) Yes ☐ b) No ☐

41. If yes or no, why? _____

42. If you rent land, were there any conditions attached to rent it?

a) Yes ☐ b) No ☐

43. If yes, what were the conditions?

_____

44. Were you satisfied with the conditions?

a) Yes ☐ b) No ☐

45. If yes or no, why?

_____

PART THREE

Differences in the yields and incomes of farmers' use of traditional and improved maize technologies.

46. What was your yield in kilograms and income for the following years?

Years	Yield (kilograms)	Income
2008		
2007		
2006		

PART FOUR

Livelihoods perceptions of farmers' use of traditional and improved maize technologies

Please indicate whether or not your selected maize technologies have contributed to the following under listed aspects of your life for each year by ticking **yes** (y) or **no** (n)**.**

47.	Livelihood indicators	2006		2007		2008	
		y	N	y	n	Y	N
a)	Did you experience an increase in savings?						
b)	Did you experience a decrease in debts?						
c)	Did you have access to credit?						
d)	Did your provision of medication to household members improve?						
e)	Did your payment of school fees improve?						

f)	Did your feeding of household members improve?						
g)	Did your support to other family members improve?						
h)	Did your fulfilment of social obligations improve? (payment of funeral dues, church dues, donations to community projects)						

APPENDIX 2

QUESTIONNAIRE FOR EXTENSION OFFICERS

Dear Respondent,

I am a Master of Philosophy student in the Institute for Development Studies at the University of Cape Coast in Ghana. This is a study to examine farmers' perceptions of the contribution of maize farming technologies to livelihoods in the Buea sub-division of Cameroon. The quest for information is purely for academic reasons. Responses provided shall be treated confidentially and uniquely for the stated purpose. Please be candid in expressing your opinions closest to the way you feel about an issue. Tick one answer where you see a box.

THANK YOU

PART ONE

Demographic characteristics of extension officers

1. Sex:

a) Male ☐ b) Female ☐

2. Indicate your age at your last birthday (in years) _____

3. Educational level:

a) First School Leaving Certificate and below ☐ d) G.C.E Advanced Level ☐

b) G.C.E Ordinary Level ☐ e) Graduate ☐

c) Professional Diploma in Agriculture ☐

PART TWO

The role of extension officers in enabling farmers to adopt and diffuse maize technologies

4. What is your language of communication to farmers about an innovation on the use of maize farm inputs and seedlings?

a) Pidgin ☐ c) French ☐

b) English ☐ d) Others (specify) _____

5. What is your method of communication to farmers?

a) Mass media ☐ c) Field demonstration ☐

b) Popular theatre ☐

6. How do farmers react when they hear about an innovation?

_____

7. What do you do when some farmers resist an innovation?

_____

8. What do you when some farmers are slow or afraid to adopt an innovation?

_____

9. How do you train farmers?

_____

10. Do you pay visits to farmers' maize farms?

a) Yes ☐ b) No ☐

11. If yes, how often? _____

12. If no, why? _____

13. How do you treat farmers with similar farm experiences?

_____

14. How do you treat farmers with different farm experiences?

_____

15. How do you help farmers to diffuse maize innovations to their colleagues?

_____

16. Do you relate with opinion leaders within the community?

a) Yes ☐ b) No ☐

17. If yes, how? _____

18. If no, why? _____

19. Do you relate with all the factions of farmers in the community?

a) Yes ☐ b) No ☐

20. If yes, how? _____

21. If no, why? _____

Thank You Very Much