AGRICULTURAL EXTENSION SERVICES AND FARMER INNOVATIONS: THE CASE OF THE GARU PRESBYTERIAN AGRICULTURAL STATION

A THESIS SUBMITTED TO THE GRADUATE SCHOOL, UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE [MPHIL] IN DEVELOPMENT STUDIES.

BY

SOLOMON S. ATIGAH

May 2010

DEDICATION

To my lovely wife, Paulina Azuma Atigah who stood by me in this endeavour, my children; Fausti, Georgina, Hagar and Ramseyer and to my parents who sacrificed all they had to finance my education.

DECLARATION

I, Solomon Samba Atigah, the author of this study hereby declare that the work presented in this thesis entitled:

AGRICULTURAL EXTENSION SERVICES AND FARMER INNOVATIONS: THE CASE OF THE GARU PRESBYTERIAN AGRICULTURAL STATION

was done entirely by me for the award of MPhil Degree in Development Studies, University for Development Studies, Tamale. This work has never been submitted in part or in whole to the university or any other institution for any purpose. All sources that I consulted in the process of the study have been duly acknowledged.

Mr. Solomon S. Atigah.

(STUDENT)
4th May 2010

Professor David Millar

(SUPERVISOR)
4th May 2010

ABSTRACT

The critical role of agriculture to the Ghanaian economy cannot be over emphasized. It has thus been the objective of governments to improve and develop the productive capacity of agriculture. Agricultural extension has been responsible for supporting farmers to raise their production capacity. Over the last two decades the effectiveness of agricultural extension to achieve its goal has been called to question. The significance of local innovation potential for sustainable development is increasingly acknowledged, but extension providers and development planners rarely attempt to develop this potential, nor do they try to disseminate local innovations within and among communities. Extension service delivery has not adequately incorporated and supported farmer innovations.

The objective of study was to examine the nature of farmer innovations in the Garu Tempane District in the Upper East Region of Ghana and how these can be incorporated into agricultural extension services for more effectiveness. Literature was critically reviewed focusing on the theoretical and conceptual explanations and discussions of agricultural extension and farmer innovation. Two main survey research instruments - questionnaires and interviews were used to collect data. Questionnaires were administered to 200 farmers from ten communities and 18 staff of formal institutions within the Garu Tempane District. Focused group discussions were held with group leaders and community experts.

The study found that most of the farmers are non literate small holders, engaged in the cultivation of a wide diversity of crops and livestock. Indigenous knowledge and practices abound in the area of study. However these are intertwined in the social, cultural and religious beliefs and practices of the people. Information on farming is freely shared usually under informal conditions. Majority of the farmers covered said they introduce changes or modify technologies introduced to them

In the light of the findings it is suggested that since farmers have a vast knowledge system that is yearning to be harnessed, extension agents must tap these experiences on a deliberate and consistent basis and not as an afterthought. Farmers are innovators and therefore extension providers must necessarily seek to involve them in the development, testing and dissemination of new technologies. From the analysis, the agricultural information systems framework holds promise for unlocking the potential in small holder farmers. Extension service providers and policy makers are urged to fully apply its principles for more effectiveness. The study also advocates for the introduction and expansion of the community based extension system. This should work especially as it was discovered that farmers use every available opportunity to spread information on farming issues amongst themselves. The changing nature of the agricultural environment calls for a new extension officer – capable, reliable, confident and above all sociable. Thus painstaking human resource development efforts will be required to make the field worker the facilitator expected of him/her.

ACKNOWLEDGEMENTS

I wish to use this space to recognize and appreciate some of the personalities that contributed to the completion of this study. In the first place, the study could not be completed without my dedicated and hard working supervisor. Prof David Millar has spent valuable time reading through and providing swift and timely responses and guidance from the development of the proposal to the field work and reporting. Mr. Samuel Bonye, a pioneer in this programme supported me especially at the proposal stage. The graduate centre staff members led by Gilbert Ansongle were very supportive and I appreciate them for that.

CARE International paid the fee for me to undertake the whole course of study that provided the opportunity to carry out thesis. I am therefore indebted to CARE for this generous offer. Similarly, the Northern Presbytery permitted me to undertake the course. I like to mention my immediate boss Mr. Dan Kolbilla who aided me in the process and the Chairperson, Rev Dr Martin Bugri Nabor.

This research could not have been accomplished without field assistants. I am grateful to my dedicated assistants like Obed Asunka, Edward Issah, Cynthia Awini, Mark Anthony and Zangina who worked diligently to ensure that the data was collected in the right manner. I wish to also recognize the important role of the respondents – farmers, group and community leaders as well as traditional experts - who spent their valuable time responding to the questionnaire as well as probing questions from the researcher.

I cannot forget my dear friend Aaron Abuosi who stepped in at crucial moments to give me the much needed support and spurred me on with reminders. Similarly it was Cletus Tindana of the Navrongo Health Research Unit who assisted in the data entry and cleaning. I say a big thank you to them.

Most of the time my family especially my dear wife (Paulina) had to do without me. I often had to vacate the house during serious engagements. Some holidays had to be

sacrificed to get the work done. In all these, I received maximum cooperation from her for which I am grateful.

In the course of the study I had to rely on the management and staff of organizations such as the Garu Tempane District office of the Ministry of Food and Agriculture, Zuure Organic Vegetable Farmers Association (ZOVFA) and the Garu Presbyterian Agric Station (Pas Garu). Some of the PAS Garu staff even read through the report and provided useful suggestions that helped to fine tune the report. Well done comrades!

Above all, I wish to acknowledge with a deep sense of gratitude, the indispensible grace of the Almighty God that provided me with strength and illumination when it mattered most; and equally worked through all the actors, events and circumstances leading to the completion of this study. To Him be glory, honour and praise both now and forevermore.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXES

ACRONYMS

AAGDS	Agricultural Growth and Development Strategy
ACDEP	Association of Church Development Projects
AIDS	Acquired immune deficiency syndrome
AIS	Agricultural Innovation Systems
AKIS	Agricultural knowledge and information system
BESSFA	Bawku East Small Scale Farmers Association
CAHW	Community Animal Health Worker
CAOF	Coalition for the Advancement of Organic Farming
CBEA	Community Based Extension Agents
CBES	Community Based Extension Systems
CBR	Community Based Rehabilitation
EA	Extension Agent
FASDEP	Food and Agricultural Sector Development Policy
FBO	Farmer Based Organization
FGD	Focus Group discussion
FI	Farmer innovation
GTDA	Garu Tempane District Assembly
GCC	Ghana Cotton Company
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
ICCO	Inter Church Coordination for Development Cooperation
ICT	Information and Communication Technology
IK	Indigenous Knowledge
MOFA/MoFA	Ministry of Food and Agriculture
MOU	Memorandum of Understanding
NGO	Non-Governmental organization
OECD	Organization for Economic Cooperation and Development
PAS	Presbyterian Agricultural Station
PCG	Presbyterian Church of Ghana
PLWHA	People Living With HIV/AIDs

PM&E	Planning, Monitoring and Evaluation
PRA	Participatory Rural Appraisal
PTD	Participatory Technology Development
R&D	Research and Development
SARI	Savanna Agricultural Research Institute
SFMC	Savannah Farmers Marketing Company
SPSS	Statistical Package for Social Science
T&V	Training and Visit System
ToT	Transfer of Technology
UDS	University for Development Studies
ZOVFA	Zuuri Organic Vegetable Farmers Association

CHAPTER ONE: INTRODUCTORY BACKGROUND

1.1 INTRODUCTION

In Ghana and many parts of the world, the role of agriculture is crucial for the development of the economy. The traditional roles of agriculture include provision of food security, supply of raw materials for industry, creation of employment and generation of foreign exchange earnings. Beyond these agriculture in the developing world is also recognized to have a greater impact on poverty reduction than other sectors. Others include the cultural values associated with farming, social stabilization and environmental sustainability (MOFA, 2007). According to the World Bank estimates, there are about 1000 million economically active people whose livelihood depends at least in part on farming (World Bank, 1997). The majority of these have incomes of less than 1 US dollar a day (Leeuwis and van de Ban, 2004).

In Ghana, agriculture is the dominant sector of the economy and provides livelihood for majority of the population. It is also the most important component of the private sector, with millions of smallholder producers and processors being predominant. In the estimation of DFID/FAO/ODI (2001), agriculture makes up over 40% of GDP and 70% of rural employment, and has untapped potential. Notwithstanding the importance of agriculture to the economy of Ghana, the industry is yet to reach its potential. According to MOFA (2007), Ghana is generally food secure with food available most part of the year. However, there are pockets of food shortages in some rural areas especially in Northern Ghana. The incidence of poverty is highest amongst food crop farmers and amongst self-employed rural people working in off farm activities such as trade.

Food security issues in the country are also affected by both local and international issues. Some local challenges are linked to policies and its implementation, and exclusion of the poor and those affected in decision making. The Ministry of Food and Agriculture confirms this view when it says: "Agricultural research and extension in Ghana has had minimal impact on the small scale traditional farmers who contribute over 80% of the countries [*sic*] food output" (MOFA, 2006: 218).

There is still a lot that needs to be achieved in terms of getting farmers to produce the right output. Agriculture's contribution to overall economic growth and poverty alleviation has been well below expectations during the last couple of decades. At the same time, agricultural extension services are under increasing pressure to become more effective, more responsive to clients, and less costly to government. Thus the effectiveness of agricultural extension to achieve its goal has been called to question not only in Ghana but in most countries the world over.

Not surprisingly there are calls to transform agricultural extension. Clearly, agricultural extension is an extremely important service which can accelerate technological, social and economic development. Small farmers in Northern Ghana are the back bone of agricultural productivity and their production system which combines crop production with keeping of livestock has through the past generations supported life in both the rural areas and generated surpluses to feed the urban centres (Millar, 2008). Farmers in Northern Ghana have received a fair share of research and extension interventions but nearly all these intervention packages have relied more on the wholesale importation of technology (ibid).

Indeed, there has been little formal work which takes account of research which documents the important role of on-farm experimentation by farmers in developing new indigenous plant varieties, new agronomic techniques, and methods for integrating the modern varieties promoted by formal sector extension services into existing farming systems (Goldstein and Udry, 1998).

In Madagascar, the findings of a World Bank research revealed a clear-cut absence of listening on the part of extension agents. In the words of one farmer: "The agricultural extension worker came into our community two years ago. He has never called us together to hear our point of view ... far be it for him to come and chat with us after work hours. Once evening falls, he goes into his house ... to exit only the following morning" (Salmen, 1999: 11).

The context for agriculture in Ghana and the world over is changing rapidly and the process of knowledge generation and use has been transformed as well. It is increasingly recognized that the value of traditional agricultural science and technology investments such as research and extension, although necessary, is not sufficient to enable agricultural innovation. New perspectives on the nature of the agricultural innovation process can yield practical approaches to agricultural development that may be more suited to this changing context (World Bank, 2006).

This new context is increasingly characterized by new policies, actors, and relationships that influence how smallholders access and use information and knowledge. This growing complexity suggests opportunities for farmers. However, little is known about how those opportunities can be effectively exploited to promote pro-poor processes of rural innovation.

1.2 THE PROBLEM SITUATION

Most development initiatives intend to reduce poverty and bring about better living conditions for local people. These intentions anticipate changes usually expected to take place within and among the people themselves. However, the distance between good intentions and achieved changes is often enormous (Limbu, 2004).

In developing countries agriculture is the principal means of livelihood for 40- 90 percent of the population. According to the United Nations (2008), agriculture is fundamental to sustainable development in sub-Saharan Africa, where the sector employs 65 per cent of labour and generates about a third of GDP growth. Nonetheless, these countries, especially those south of the Sahara, experience periodic or chronic food shortages. Strengthening the ability of agriculture to compete domestically and in export markets by means of balanced economic policies is therefore an important requirement of an economically competitive agricultural sector, and concomitantly, successful agricultural extension activities. Agriculture, however, must be more than economically competitive. It must also be sustainable, which entails conserving natural resources, such as soil, water

and biological diversity, and taking into account agriculture's social and cultural context. This complex challenge can only be overcome if traditional and new knowledge are effectively combined in new production systems that are compatible with the cultural and social values of rural societies. Contributing to the development of such systems will be one of the most important tasks of agricultural extension over the next decades.

After the Second World War development organizations saw the opportunity to assist developing countries achieve higher growth rates through the transfer of technology approach. In agriculture this meant formal agricultural research organizations developing technology packages and transferring them to farmers through extension agents (Gottret, 2007). This approach sees scientists as innovators and farmers as adopters but not as sources of innovation in their own right (ibid). This belief fuelled huge investments in agricultural research and technology generation, culminating in what came to be known as the green revolution. In Ghana and in many other countries, the failed 'transfer of technology' (ToT) model has until recently been the prevalent practice for developing and spreading agricultural innovations. It is based on the assumption that a transfer of technology and knowledge from scientists to farmers will trigger development.

Until the 1980s, development planning was usually based on very negative assumptions about traditional rural societies. Poor rural dwellers were generally assumed to be backward and resistant to change, and their livelihood practices, such as shifting cultivation, were thought to be at best inefficient and unproductive and at worst environmentally destructive. But starting then, these people began to gain broader respect for their cultural richness, their sophisticated natural resource management expertise, and their agricultural and health-related knowledge (Dutfield, 2006). Some development projects in Africa have found that technologies generated by farmers from locally-available resources are likely to be more relevant to the majority of smallholder farmers than introduced technologies that depend heavily on external inputs (ibid).

Some authorities in agricultural extension insist that from the time that agriculture began when there was no extension services, farmers came up with ideas, carried out

experiments and arrived at their own conclusions. Innovations that proved effective thrived (Millar, 2008; Critchley, 2007; Okry and van Mele, 2006).

Local communities have an endogenous potential for innovation that allows them to adapt to changing socio-cultural, political, economic and environmental conditions and to improve their livelihoods, develop their own visions, and negotiate their own priorities. The significance of local innovation potential for sustainable development is increasingly acknowledged, but extension providers and development planners rarely attempt to develop this potential, nor do they try to disseminate local innovations within and among communities (CDE, 2008).

Okry and Van Mele (2006) posit that out of necessity, and based on their cultural background, inherited knowledge and daily observations, farmers have generated solutions to their own problems. Unfortunately, these innovation processes, their results and potential for scaling-up are poorly studied and documented. Recent literature on African indigenous knowledge, especially in agriculture, emphasizes that Africans are informed innovators with success stories in crop breeding, grafting against pests, water harvesting, soil management, conservation and processing (UN, 2008).

It is evident that a lot of farmer innovations are taking place on the blind side of extension service providers. Sometimes these innovations are simply ignored or down played or poorly managed. Following renewed interest in local and farmer innovations, it is important to reflect on the extent to which farmer innovations are taken into account by extension agents and how to incorporate these gains and support farmers to develop and upscale them. These considerations have given birth to the research problem. The research problem that confronts this study is that ***extension service delivery has not adequately incorporated and supported farmer innovations. This situation has resulted in the inability of extension agents to effectively address the concerns and needs of poor rural farmers.***

1.3 MAIN RESEARCH QUESTION

What are the main farmer innovations and how can these be incorporated into agricultural extension service delivery?

1.3.1 Specific Research Questions

1. What traditional systems/structures support farming activities in the communities?
2. What farmer innovations are available in the communities?
3. What are the main extension approaches and strategies in the government extension service providers?
4. What are the main extension approaches and strategies being adopted by private extension providers like the Garu Presbyterian Agric Station?
5. Are there any gaps between extension services and farmer innovations?
6. How can farmer innovations be incorporated into agricultural extension?
7. How can extension service delivery be made more effective?

1.4 MAIN RESEARCH OBJECTIVE

The objective of the study is to examine the nature of farmer innovations in the study area and how these can be incorporated into agricultural extension services for more effectiveness.

1.4.1 Specific objectives

The specific objectives of the study are to:

1. Identify traditional systems that support farming activities
2. Investigate what farmer innovations are available in the communities
3. Examine the extension approaches and strategies used by both the government and private extension service providers
4. Determine the gaps (if any) between extension service and farmer innovations
5. Examine ways of incorporating farmer innovations into agricultural extension services

6. Make recommendations for extension service providers to improve their effectiveness

1.5 JUSTIFICATION OF THE STUDY

In an era when the effectiveness of agricultural extension has been called to question the study is expected to contribute to make extension services more relevant to the needs of smallholders. In an ever changing agricultural environment the need for a new perspective in the extension agent-farmer relationship cannot be overemphasized. The concept of innovation has been used predominantly to explain patterns of past economic performance in developed countries and has received far less attention as an operational tool (World Bank, 2006). It has been applied to agriculture in developing countries only recently, but it appears to offer exciting opportunities for understanding how a country's agricultural sector can make better use of new knowledge and for designing alternative interventions that go beyond research system investments. It is thus my hope that the study will make recommendations that contribute in finding solutions to production constraints faced by the rural farmer.

1.6 ORGANIZATION OF THE REPORT

The study is organized into five chapters. Chapter two reviews the relevant literature from related studies such as the concept of extension, methodologies, approaches to extension service delivery, innovation systems concept, agricultural innovation systems, farmer innovation and concludes with a review of extension policies in Ghana. Chapter three examines the framework and the methods employed to address the objectives of the study. Data used, sources and methods of data collection are also described in chapter three. Chapter four presents the findings and discussions of the study. Chapter five summarizes conclusions of the study and also revisits the research questions and objectives. Finally, recommendations are also presented in chapter five.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter examines the theoretical underpinnings in agricultural extension. It begins with the historical development of agricultural extension and attempts to explain what it is all about. The concept of extension approach will be examined, clarifying crucial terms like methods, methodology and tools. Some of the approaches to extension are identified and discussed. Similarly the concept of innovation will be explored. The innovation systems Concept as well as the Agricultural Innovation System are explained. The concept of farmer innovation is examined together with some discussion of traditional farming systems. The section concludes with a review of some of the extension policies in Ghana.

2.2 AGRICULTURAL EXTENSION

2.2.1 Background

Agricultural extension may be regarded as a significant social innovation, an important force in agricultural change, which has been created and recreated, adapted and developed over the centuries (Jones and Garforth, 1997). The term extension was first used to describe adult education programmes in Cambridge University in 1873, followed immediately by Oxford. These programmes helped to expand - or extend - the work of universities beyond the campus and into the neighbouring community (Ackah-Nyamike, 2007; Swanson and Claar, 1984). The objective of university extension was to take the advantage of university education to ordinary people. The term was later adopted in the United States of America, while in Britain it was replaced with 'advisory service' in the 20th Century (ibid).

The birth of the modern agricultural extension service has been attributed to events that took place in Ireland in the middle of the 19th Century. Between 1845 and 1851 the Irish potato crop was destroyed by fungal diseases and a severe famine occurred. The British Government arranged for 'practical instructors' to travel to rural areas to teach small

farmers how to cultivate alternative crops. This scheme attracted the attention of government officials in Germany, who organized their own system of travelling instructors. By the end of the 19th century, the idea had spread to Denmark, Netherlands, Italy, and France (Jones and Garforth, 1997).

The development of agricultural extension in Third World countries was to a large extent a post independent event, occurring mainly after the Second World War (Swanson and Claar, 1984). Majority of national agricultural extension organizations in Latin America and the Caribbean were started in the mid 1950s with a few starting in the 1960s. The case of Asia was a little later with a few actually beginning in the 1970s. In Africa, national agricultural extension organizations started mostly in the 1960s and 1970s (ibid).

2.2.2 Agricultural extension defined

Agricultural extension is a difficult term to define precisely. It has different meanings at different times, in different places, to different people. It will be appropriate to examine a few definitions that scholars and practitioners have provided. To Brunner and Hsin (1949) the central task of extension is to help rural families help themselves by applying science, whether physical or social, to the daily routines of farming, homemaking, and family and community living. Group (1999:11), on the other hand contends that "the essence of agricultural extension is to facilitate interplay and nurture synergies within a total information system involving agricultural research, agricultural education and a vast complex of information-providing businesses".

Extension [is] a series of embedded communicative interventions that are meant, among others, to develop and/or induce innovations which supposedly help to resolve (usually multi-actor) problematic situations (Leeuwis, 2004). It is not difficult at this stage to realize that in the maze of definitions one of the common elements contained in the various definitions of extension is the fact that, extension is an intervention. It seeks to influence positively in the human endeavour and from that perspective may be regarded as human centred. Although interventions may take various forms, from the point of view

of extension, it involves planning and formulating goals, objectives and strategies, implementing programmes and evaluating same.

Similarly, extension is seen as a professional activity that is undertaken by organizations. It requires the use of a combination of resources like personnel, material and financial. These resources must be coordinated and applied prudently. Programmes must be drawn up and implemented in order to achieve the needed results. From the foregoing, it is evident that the function of agricultural extension is to help people or farmers for that matter to solve their own problems through the application of scientific and indigenous knowledge.

2.2.3 Extension methods, methodologies and tools/techniques

Extension methods can be seen as a particular mode of using media and media combinations. A method can (but need not) be an element in a methodology. The available extension methods identified are: individual, group and mass methods (van den Ban & Hawkins, 1988; Kang & Song, 1984). Extension methods can also be classified according to the nature of the learning experience (experiential, reinforcement and integrative) or the number of people reached (individual, group and mass methods). Examples of individual methods may include farmer visits, office visits, and telephone calls. Some of the common group methods include; method and result demonstration, field days, role plays, simulation games, folk media, group meetings and tours and field trips.

The objective of mass extension is to address a large number of people at once. These people are not in close contact with each other. Mass extension methods are characterized by a one-way flow of information with the emphasis on the use of communication aids. For mass methods, examples include newsletters, visual aids, broadcast, posters, etc.

Experiential methods allow the audience to gain experience with the information being taught. It involves hands-on activities that utilize the senses. These methods are excellent

for teaching new information. Research suggests that the more the audience can interact with the information being taught, the better they will learn and retain the information (Simpson and Owen, 2002; Kang and Song, 1984). Some experiential methods include: Case study, field day, interactive workshop, interactive video, practicum, role play, games, etc.

Reinforcement methods support learning and provide motivation for continued learning. They also reinforce information that farmers already know. Some reinforcement methods that are well suited for Extension include: leaflets, posters, fact sheets, newspaper articles, newsletters, etc

Integrative methods allow the learner to clarify, discuss, and gain a greater understanding of the information; and integrate new information with existing information. The learners gain increased in-depth knowledge of a topic. Some integrative methods include: brainstorming, buzz, meeting, forum, conference, personal visit, etc.
The choice of a method depends on the nature of message being passed, the target audience, the environment in which the message is passed and the preferences of the facilitator.

Methodologies, according to Leeuwis and van de Ban (2004) are basically pre-defined series of steps or procedures, whereby each step can involve the use of one or several methods. Methodologies are often known under a particular label or acronym. Examples of methodologies relevant to extension are: Farmer Field Schools (FFS) (Hagman et al, 1999; Scarborough *et al,* 1997); Participatory Rural Appraisal (PRA) (Chambers, 1994); Participatory Technology Development (PTD) (Jigins and De Zeeuw, 1992).

At this stage it will be appropriate to turn to the concept of the agricultural extension approaches and to discuss some of the approaches adopted by organizations to accomplish their mission.

2.2.4 Approaches to Agricultural Extension

Over the past four decades, many different approaches have been used to develop the different national agricultural extension systems. It is thus important to understand these approaches in order to understand extension itself and to recognize some of the strengths and weaknesses of each approach. Before examining these approaches it will be appropriate to dwell briefly on the concept itself – extension approach.

An extension approach refers to the basic planning philosophy that is being adopted by agricultural extension organizations (Leeuwis and van de Ban, 2004; Hagmann et al, 1998). This helps extension personnel to understand the fundamentals, concepts and functional methods of extension adopted to fulfil its goals and objectives. In a broad sense an extension approach then is synonymous with an extension system. It must consider all elements of the system – clients groups, the contents of extension, the organizational set up and staff, the methods and extension aids to be used and the objectives and working programme to be used (Hofman, 2006). Nagel (1997) presents extension approaches in terms of their most important organizational forms and their respective goals. The goal system reflects the power positions of various groups of actors. Therefore, without an understanding of the historical development and of the interest groups involved, present achievements and shortcomings, extension approaches cannot be evaluated. In practice however, approaches have tended to assume fuzzy labels and therefore defy any systematic classification.

Some of the common approaches as presented by Nagel (1997) and Swanson and Claar (1984) include: Ministry-Based /General Extension, Training and Visit Extension (T&V), Integrated (Project) Approach, University-Based Extension, Animation Rurale, Commodity Based Extension, and Client-Based and Client-Controlled Extension. Thereafter, each of these approaches will be discussed briefly. Although these views on extension approaches are not necessarily contradictory I doff my hat for Hofman's (2006) view that it is a system and that all elements should be examined.

Ministry-Based General Extension

After independence, many African and Asian governments organized agricultural extension work under the wings of the ministry of agriculture. All important aspects of small-holder agriculture - plant production, animal husbandry, home economics - could be attended to as the ministry established respective sections under its jurisdiction (Nagel, 1997). This system is also known as the Conventional Agricultural Extension Approach (Swanson and Claar, 1984).

The basic assumption with this approach is that technology and information are available which are not being used by farmers. If knowledge of these could be communicated to farmers, farm practices would be improved.

Programme planning is controlled by government, and changes in priority, from time to time, are usually made on a national basis, with some freedom for local adaptation. Decisions about the goals and objectives of the extension programme are made within the ministry of agriculture, sometimes involving participation by many professional, administrative and political personnel. An early warning system for food security and agricultural diseases monitoring is an essential component of the approach.

Ministry based extension has its weaknesses and drawbacks. One difficulty of this approach is the contradictory nature of goals. Public interest implies serving farmers and the urban population, securing subsistence production and promoting cash crops for export, reaching the masses of rural households and serving the needs of specific groups, extending assistance to high-potential and disadvantaged producers. All too often priorities are pro urban in terms of price policy, favouring innovative individuals within the modern sector, neglecting poorer strata, and forgetting about women farmers (Nagel, 1997). Thus, many extension workers select the more responsive section of their clientele.

The services are organized under hierarchical and bureaucratic conditions and these hamper a full realization of their potential. Ministry-based extension has been unable to reach a majority of its potential clientele for economic, socio-psychological, and

technical reasons. Even dramatic quantitative increases in personnel - more staff closer to the farmer - have not produced manageable client-to-agent ratios (Nagel, 1997).

Training and Visit Extension (T&V)

In the strict sense of the word, T&V is not a separate approach but an attempt to reform and improve the effectiveness of ministry-based extension (Nagel 1997; Ntifo-Siaw and Agunga, 1994; Swanson and Claar, 1984). It was promoted mainly by the World Bank, which had invested over $2 billion in T&V extension activities worldwide by 1988 (FAO, 1990).

This approach assumes that extension field personnel are poorly trained, not up-to-date, and tend not to visit farmers, but to stay in their offices. It further anticipates that management and supervision is not adequate. Extension staff members are supposed to be in close contact with relevant scientific developments and research in order to formulate specific recommendations that will be useful to farmers.

The extension service must be under a single line of technical and administrative command. Under the T&V system, all farm families under the jurisdiction of one extension worker (AEA) are divided into 8 groups of about equal size of 100. Contact farmers represent about 10 percent of each group. On average, one extension officer will work with ten contact farmers in each of 8 villages. This means there will be 80 contact farmers who will represent 800 farm families. One Agricultural extension Officer (AEO) will be required to supervise, train and guide 6 AEAs. A number of AEOs (6-8) will intend be backstopped and supervised by a single Sub-divisional Extension officer and so on (Swanson and Claar, 1984).

AEAs are responsible solely for extension message delivery. Staff members are not responsible for the supply of inputs, data collection, distribution of subsidies, processing of loans, or any other activities not directly related to extension (Nagel, 1997). Messages and skills must be taught farmers in a regular, timely fashion, so that they will make the

best use of the resources at their command. AEAs must visit farmers regularly on a fixed day and the schedule known to farmers.

Ntifo-Siaw and Agunga (1994: 37) have reported extensively on Ghana's involvement in the T and V system:

> *...Ghana adopted the T&V system because of its promise of improving extension management--the key to increased agricultural production and national development.*
>
> *The Upper Region (now Upper East and Upper West regions) was the first to adopt the T&V system in Ghana in 1978. Ghana obtained a World Bank loan that year to implement the Upper Region Agricultural Development Program (URADEP) and T&V was a component of that loan package. The Volta Region also adopted the T&V system when Ghana obtained another World Bank loan for the Volta Region Agricultural Development Program in 1981.*

The T&V system has come under serious criticisms from practitioners and commentators. Some studies indicate "the lack of significant difference between the general and T&V extension organizations in terms of performance effectiveness" (Ntifo-Siaw and Agunga, 1994:39). According to the World Bank (1999:6) "the performance of the T&V system as applied in Kenya has been disappointing. The system as implemented has been ineffective, inefficient, and unsustainable."

Some of the reasons for these criticisms can be attributed to the limitations and weaknesses inherent in the T & V approach. First there is a high term costs to governments of expanding the size of field extension staff. Second, there is a lack of actual two-way communication which is assumed in this approach between research and extension staff, as well as between extension staff and farm people. Third, there is no adequate supply of simple, low cost technology which is relevant to the farmers who are targeted. Fourth, it is based on a traditional top-down supply-driven approach that provides little or no voice to the farmer (World bank, 1999). Therefore, farmers' participation in technology transfer programs under T&V did not differ from that of general extension (Ntifo-Siaw and Agunga, 1994).

Extension/research linkages are rated low, meaning that the claim that T&V enhances this linkage had not been proven. Research-extension linkage in Ghana may be constrained by the fact that extension and research are located in separate ministries.

Commodity Based Extension

In this approach to extension, a private or parastatal organization provides the farmer with a complete technological production package and guarantees the processing and marketing of the goods. It tends to focus on one export crop, such as cocoa, sugar, cotton, or rubber. Alternatively, they sometimes focus on one aspect of farming, such as livestock, dairy, irrigation or fertilizer.

The Ghana Cotton Company (GCC) for instance, does extension work in cotton, both with smallholders and with large farms. It coordinates all aspects of production and marketing, including extension education.

Compared to other approaches, this is less complex and more straightforward. Extension programme planning is controlled by the commodity organization. The GCC decides what should be the goals of the extension programme, what should be the extension message, the timing of activities in the extension programme, who should participate in which aspects of that programme, and who should be the officers of the extension staff. Messages in the form of instructions are often done by word of mouth in face-to-face conversations, either on individual farmers or at group meetings. Demonstrations may also be used, but less with this approach than with others.

It has the advantage of having potentially very high return to the farmers with relatively low risk. In addition, technologies tend to address the production problems while messages will usually be delivered in a timely manner. The approach responds to market needs.

One disadvantage of this approach is that it may have less emphasis on environmental, occupational and nutritional impacts, in view of the profit motive. It is often crop specific

and thus has a limited impact on general agricultural development. Consequently it has limited emphasis on community empowerment and general capacity building. The interests of farmers may have less priority than those of the commodity production organization.

Integrated (Project) Approach

Integrated approaches aim at influencing the entire rural development process. Extension is only one though often crucial element in this strategy which targets the entire population in a given area but emphasizes work with disadvantaged groups (Nagel, 1997). Measures to promote production are coupled with a strong emphasis on self-help. The underlying concept is typically multisectoral (ibid).

Evaluations of more than a decade of integrated rural development projects have revealed serious shortcomings in reaching the goal of mass poverty alleviation (IBRD, 1987, cited in Nagel, 1997). Sizeable numbers of the poor were not reached by project activities, nor were positive effects consolidated on a sustainable basis (ibid).

The approach has a high possibility of having management deficiencies partly because of underestimation of the great complexity of multisectoral programmes with ambitious goals and lack of compatible technical solutions.

University-Based Extension

While the Cooperative Extension Service (CES) of the United States is still the only system in which the main extension function remains within the university, some developing countries, notably India, have integrated educational institutions into practical extension work. Within the United States of America, state universities have traditionally cooperated with local counties and the U.S. Department of Agriculture in doing extension besides education and research. Within the last 130 years, extension goals of the land-grant colleges have shifted from practical education to technology transfer and, more recently, to a much broader concept of human resource development (Nagel, 1997).

CES is facing new challenges with regard to coordination and cooperation in view of dramatic changes within the agricultural production sector. Apart from its traditional roles, networking will become a primary role (Bennet, 1990:16 and cited in Nagel 1997). In this model, industry as well as intermediate and end users of knowledge become part of the extension system.

Some Indian agricultural universities have come close to the U.S. model without taking over the full load of extension work. In the field, they have taken over functions which are only inadequately performed by the ministry, thus supporting general extension work. Remarkable features are direct assessment of clients' needs, user-oriented research, quality training for state personnel, and a strong linkage between academic education and field practice.

Animation Rurale

For a historically rather short period, the concept of Animation Rurale (AR) gained importance in francophone African countries such as Senegal, Ivory Coast, and Madagascar (Joerges, 1967). Though the original approach is no longer pursued, some of its elements are now being reintroduced into rural development programmes. Animation Rurale was an answer to the authoritarian and often repressive nature of interventions before independence. It was developed originally by the French Institut de Recherches et d'Application des Méthodes de Développement (IRAM) (Nagel, 1997).

Integration of rural areas into the national system was to be achieved by initiating a dialogue between rural communities and the state. The idea was that increasing competence of villagers to express their own needs was to liberate them from colonial dependence. In order to initiate and perpetuate this process, AR relied on a large number of voluntary collaborators, known as "animateurs" (ibid). Animateurs were selected by the villagers themselves and had to be experienced and well-respected farmers but not traditional leaders. The Ministry of Rural Development organized training, supervision, and support for animateurs. Their task was to initiate discussions within the community

on local needs and objectives, thus empowering rural people for a dialogue with the state. At the same time they were to interpret government plans to the villagers and acquaint them with services available.

AR did not achieve the desired impact because the objectives were extremely difficult to operationalise and, as a result, the role of animateurs remained unclear. In addition, lack of rewards and selection mistakes contributed to the fact that many animateurs soon lost interest in their work. Farmers, as it turned out, were more interested in receiving qualified technical assistance, and even if animateurs had successfully initiated village projects, it was the technicians who reaped the benefits.

What has remained is the philosophy of empowerment and many of the practical experiences. Many NGOs use the ideas of Animation Rurale often without realizing their roots. The present discourse on participatory extension shows the lasting influence of AR.

Client-Based and Client-Controlled Extension

This approach seeks to localize extension and utilize the self-help potential of rural groups. Often organized by outsiders, these decentralized approaches are in a better position to serve the needs of specific target groups, notably those in disadvantaged positions. Close contact with their clients and intimate knowledge of their life situations are essential for the planning of problem-oriented extension activities (Nagel, 1997). Local personalities are identified who take over leader functions once the external (nongovernmental) organization withdraws. The principles of these organizations (awareness, empowerment, participation, self-help) are close to the philosophy of Animation Rurale without the national dimension.

Community Based Extension (CBE)

Community based extension systems are ways in which members of the community provide extension services to their colleague farmers to enable them undertake their farming activities (CARE International, 2005). The services provided could be in the form of inputs, information or support to facilitate decision making. Community based extension systems either build on existing community institutions such as chieftaincy,

clan systems or establish structures within the community such as the formation of peer groups to facilitate access to services. These systems evolve in response to community needs and are suited for the transmission of specific types of information.

For the Garu Presbyterian Agricultural Station, a community based extension system is a system of extension delivery where different institutions and service providers within and outside the community disseminate indigenous and scientifically generated technology and information within the community with its members playing leading roles for improvement of lives. Sumbo et al (2006:2) see the model as "... a cost effective system that provides farmers the opportunity to enhance their knowledge base. The system builds on both indigenous and orthodox crop production, animal husbandry and other natural resource issues such as bush fire prevention and management."

The approach also seeks to link farmers, through their community-based extension providers and systems to formal extension and research service providers. Therefore the arrangement not only creates access to innovations but also access to joint development of such innovations through participatory action research. It is important to note that at the heart of community based extension system (CBES) is the key actors who are referred to as community based extension agents (CBEAs).

2.3 THE CONCEPT OF INNOVATION

2.3.1 Introduction

This section examines the concept of innovation itself. The term is very interesting to explore but not without pitfalls. Roling (2006:1) captures it very well in the following statement:

> *Innovation is a sexy concept that appeals to left and right, and young and old, including Mzees like myself. Innovation has promise, it sounds like a way forward. It is easy to get people behind it. But beware! The concept is used in different meanings. It can represent very different perspectives. It can lead to considerable confusion...Sometimes it is in need of innovation itself!*

In the light of the timely caution of Professor Neils Roling, It will be appropriate to proceed by defining the boundaries of the discussion. First I will discuss the innovation systems concept, then the Agricultural innovation Systems (AIS) and conclude with the issue of farmer innovations in the context of this paper.

The Organization for Economic Cooperation and Development (OECD) (1999) regards an innovation as any knowledge (new or existing) introduced into and used in an economically or socially relevant process. The term innovation includes not only the adoption of a new production technology by a smallholder but also a range of other processes, such as the reorganization of marketing strategies by a group of smallholders, the use of a new learning and teaching method by agricultural extension agents, and the introduction of a new processing technique by an agro-industrial company (Spielman, Davis, Negash, and Ayele, 2008).

2.3.2 The innovation systems concept

In the neoclassical economics tradition, innovation is understood to be induced by the relative scarcity of factors (Berdegue, 2005). It follows that there is a lineal, input/output relationship between agricultural research, development of technology and its dissemination, and at the end, adoption by farmers leading to economic and social effects and impacts (Hall, 2007; Kline & Rosenberg 1986 as cited in Leeuwis & van den Ban, 2004: 135).

This paradigm of linear technology diffusion has been criticized on several grounds. First, it failed to understand the source, nature, and dynamics of most innovation processes, particularly in the context of developing countries (Roling, 2006; Leeuwis & van de Ban, 2004). Second, the expression of linear farm development made change agents prefer particular types and patterns of innovations - reflecting a kind of blindness for alternative directions (Leeuwis & van de Ban, 2004). Thirdly, it failed to pay sufficient attention to the distributional or equity issues related to innovation (Röling, 2006; Engel and Salmon 1997).

Thus the Innovations systems framework emerged as a response to the limited explanatory power of conventional economic models that view innovation as a linear process driven by the supply of research and development (Hall, Mytelka & Oyeyinka 2006). Consequently, the innovation systems concept emerged through policy debates in developed countries in the 1970s and 1980s (Spielma et al, 2008; World Bank, 2006). These debates centred on the nature of industrial production and the analytical frameworks that were required to explain patterns of industrial growth. Industrial production then was becoming more knowledge intensive as investments in intangibles such as research and development, software, design, engineering, training, marketing, and management came to play a greater role in the production of goods and services and in organizational competitiveness. Such investments often created tacit rather than codified knowledge. Unlike codified knowledge, which is explicit and recorded, tacit knowledge is often embedded in skills, beliefs, or ways of doing things. Thus, mastering tacit knowledge requires a conscious effort at learning by doing, by using, and by interacting (Hall, et al 2006; World Bank, 2006).

Gradually the knowledge intensity of production was extended beyond the high-tech sectors to reshape a broad spectrum of traditional industries. Competition among firms became less on the basis of price and more on the basis of their ability to design novel products or improve the quality management of their production. This put pressure on local firms to engage in continuous innovation, and they are challenging governments to develop policies to stimulate and support an innovation process (Hall et al, 2006).

The innovation systems perspective has become increasingly important in explaining how innovation takes place and how and by whom benefits are gained out of complex technological and institutional change processes. This is because conventional economic models, which view innovation as a linear process driven by the supply of R&D, cannot fully explain these trends in industry or offer much guidance for policy makers. Alternative explanations of the innovation process have emerged from the evolutionary economics tradition.

Several investigators discovered that the more successful economies possessed what they described as an effective national *system of innovation* (Hauknes, 1999). These systems developed in an institutional (often network-based) setting, which fostered interaction and learning among scientific and entrepreneurial actors in the public and private sector in response to changing economic and technical conditions (Rajalahti, Janssen, & Pehu, 2008) The continuous process of innovation that emerged from this setting was viewed as central to the economic success of countries such as Japan in the 1980s (Hall, 2007; World Bank, 2006; Hauknes, 1999). Over time, the innovation systems concept has gained wide support among the member countries of the Organization for Economic Cooperation and Development (OECD).

Although the innovation systems concept is relatively new to agricultural policy makers and agricultural research managers in developing countries, it is increasingly suggested as a way of revisiting the question of how to strengthen agricultural innovation capacity (Hall, 2007). The next concept to be introduced as applied to agriculture is the agricultural innovation systems.

2.3.3 Agricultural innovation systems

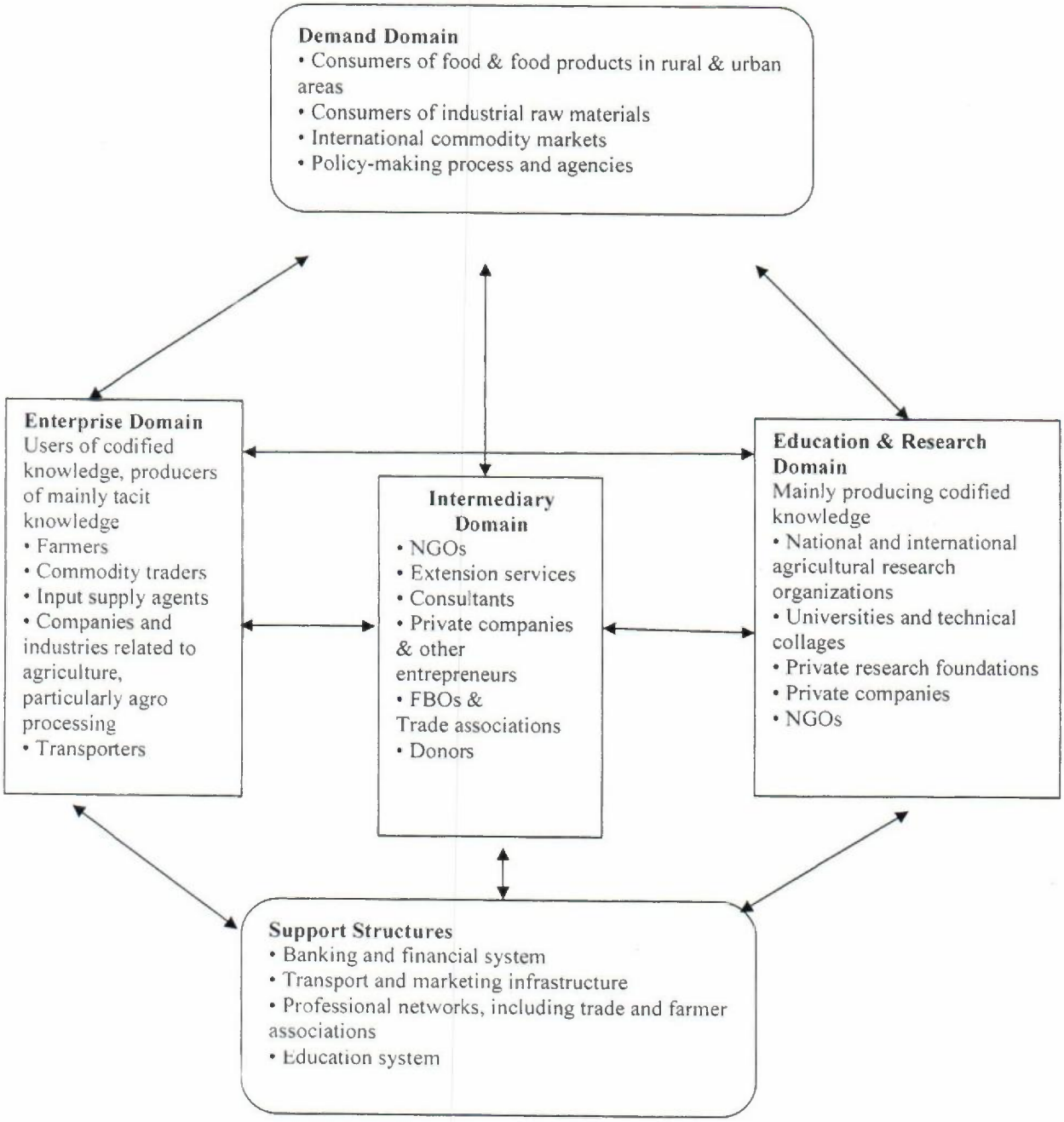
Lessons from applying the innovations systems perspective in the industrialized world have been used to conceptualize the Agricultural Innovation Systems (AIS) perspective. This has added value to the conventional, linear perspective on agricultural R&D, by providing a framework for analyzing complex relationships and innovative processes that occur among multiple agents, social and economic institutions, and endogenously determined technological and institutional opportunities (Spielman et al, 2008). Given its industrial origin, current studies of AIS place much emphasis on the market and other institutional forces that affect innovation processes in agriculture (Rajalahti et al, 2008; World Bank, 2006).

The last four decades have witnessed considerable debate over the best way for science and technology to foster innovation. The first view to emerge was that scientific research is the main driver of innovation; research created new knowledge and technology that

In contrast to most economic frameworks that focus on production this framework focuses on innovation. The framework stresses that innovation is neither research nor science and technology, but rather the application of knowledge in production to achieve desired social or economic outcomes. This knowledge might be acquired through learning, research or experience, but until applied it cannot be considered innovation. Although this knowledge can be new, innovation often involves the reworking of the existing stock of knowledge, making new combinations and/or uses (Hall et al, 2006).

Figure 2.1 portrays the elements of an Agricultural Innovation System. It comprises of five main interacting domains: the demand, enterprise, education and research, support structures and the intermediary domains.

Figure 2.1 Elements of an Agricultural Innovation System



Source: Adapted from Rajalahti et al, 2008:4

Rajalahti et al (2008) outline six major changes in the context of agricultural development that call for the need to reexamine how innovation occurs in the agricultural sector:

1. Markets, not production, increasingly drive agricultural development.
2. The production, trade, and consumption environment for agriculture and agricultural products is growing more dynamic and evolving in unpredictable ways.
3. Knowledge, information, and technology increasingly are generated, diffused, and applied through the private sector.
4. Exponential growth in information and communications technology (ICT) has transformed the ability to take advantage of knowledge developed in other places or for other purposes.
5. The knowledge structure of the agricultural sector in many countries is changing markedly.
6. Agricultural development increasingly takes place in a globalized setting (in contrast to a setting characterized predominantly by national and local influences and interests).

The farmer innovation system approach allows for interactions and integration between stakeholders, resulting in social learning. This enables the stakeholders to identify and recognise their experimentation efforts, responsibilities, strengths and weaknesses, thereby strengthening participation and community innovation processes (Opondo et al, 2005).

2.3.4 Farmer innovation

So far the innovation systems concept and agricultural innovation systems have been examined. It will be proper to now focus on the concept of farmer innovation in the context of the rural situation. According to Millar (2008) and the World Bank (2004), farmer innovation and local innovation are used in the same sense and refer to the dynamics of indigenous knowledge i.e., knowledge that grows within a social group,

incorporating learning from own experience over generations, but also external knowledge internalised within the local ways of thinking and doing. This concept embraces, not only technological findings, but also new ways of managing livelihood in general.

Promotion of farmer innovation fosters individuals or groups to discover and develop better ways of managing resources, by building on and expanding the boundaries of their indigenous knowledge through interactions. Innovations can occur both in technical and socio-institutional spheres. Wu, Flynn and Merdsen (2004) argue that innovations are broadly related to the introduction, adoption or creation of either or both elements of "new knowledge" (ideas, skills or experience) and "new organisation" (principles, forms, networks or mechanisms). In this study, the concept of farmer innovation will be understood in this sense. It is applied to agriculture technology processes that aim to improve rural livelihoods for sustainable development while ensuring inter-institutional and farmer learning.

Based on the above, Spielman et al (2008) define an innovation agent as someone who introduces or uses such knowledge - a process that entails seeking information from various sources and integrating elements of the information into social or economic practices that somehow change the behaviours and practices of individuals, organizations, or society.

"Farmer innovators" are farmers or land users who innovate, test and try new methods of conservation or production, on their own initiative, often using ideas from various sources. Innovators tend to be curious, creative, proud of their innovations, willing to take risks and are skilful in blending their own ideas with ideas picked up elsewhere (Critchley, 2007).

The process of innovation involves constant experimentation, improvisation, adaptation, and simultaneous rejection of certain results either partly or completely depending upon individual or collective feedback. Many times, while searching for innovations, people

have drawn negative inferences about the innovative potential of peasants. They were either looking for the wrong things, or looking through inappropriate prisms, or asking the wrong questions in the wrong places (Gupta, 1992). Investing resources and time in Farmer innovation is worth doing. Whereas the formal system is getting attention in terms of resources and policy support, the farmer innovation system which is driving the livelihood system of millions of farmers is receiving little attention.

Researchers and development practitioners know only very little about farmer innovation (FI), not because it is the upper limit but because there is no conscious and systematic linkage between the agricultural scientists and farmer innovators. The two systems, although complementary, are not feeding to each other consciously and meaningfully. The farmer innovation system is not adequately considered as a source of inspiring technologies. The mind boggling question then is how can we make our assistance to small holders be more realistic, appropriate and sustainable by making conscious support to farmer innovation systems?

The outcome of the farmer innovation process can be improving indigenous knowledge practices, appropriation of modern practices to fit own reality or finding out something new. Farmer innovators are not like the "model farmers" who are intentionally trained by extension workers on specific and pre-determined technologies. Farmers, especially resource poor farmers, continuously experiment, adopt and innovate (Millar, 2008)

Farmer innovation does not mean exactly like IK. Indeed, IK is a collective name, which broadly encompasses the traditional knowledge and/or a knowledge that belongs to the present generation, which is developed by the local people. FI on the other hand embraces, not only technological findings, but also new ways of managing livelihood in general. The approach is not primarily used to develop innovations and spread them out to other farmers. In the same vein, Roling (2006) argues that it is essential to throw open the concept of innovation to the realisation that it can include indigenous development, social learning, concerted action and emergence from interaction.

From the discussion so far it is evident that the farmer innovation system is not so visible and therefore not adequately recognized by policy makers, technocrats, researchers, international and national development partners, although it is driving the livelihood systems of the small farmers. It is time to turn the tables in favour of farmer innovation.

2.4 POLICY ON AGRICULTURAL EXTENSION IN GHANA

A policy provides the overall framework which determines a government's aims and activities, while plans, programmes and projects emanating from this framework represent the means of implementing a policy in order to meet stated objectives (CTA, 2002). Thus, policy on agricultural extension is a framework or principles under which its operation is based. Policies are very important in all sectors of development endeavour. It is these policies that direct the development efforts. The agricultural sector in Ghana has not been an exception right from colonial rule up to self rule.

The agricultural policy pursued during the colonial period was aimed at advising and assisting farmers to produce larger and better crops for export to the neglect of food crops or non-export crops. According to Millar (2004), sufficient revenue was generated which addressed basic food requirements in the urban and cash crops production areas through the importation of staples from external markets. The foreign earnings from the export-crops could have been used for something other than importation of staples if equal attention was given to the home agricultural sector for the production of staples. The policy of Convention People's Party had a different focus. It was directed at promoting rapid agricultural development through the establishment of state farms which used mechanized agricultural systems and agricultural development corporations (Millar, (2004). This policy demonstrated the power of government since urban unemployment was mitigated and the department of agriculture was abolished. The abolition of the extension service denied smallholders the service which could have promoted or augmented the production of food crops to sustain the country. Between the 1961 and1982, the directions of policy pursued was also different. It was in favour of large scale production and industrialization based on imported raw materials rather than industrialization based on agricultural surpluses (home-agriculture) (Millar, 2004). This

direction promoted production and marketing of agricultural commodities but to the neglect of the smallholder, who form the majority in the agricultural sector.

All the policies discussed so far did not favour the smallholder except the one between 1981 and 1992 even though not completely. This policy sought to build a conducive and enabling environment which promotes agricultural growth and development in terms of promoting national food security, creating rural employment opportunities where the smallholder dominates, providing agricultural-industrial linkages and a balanced regional agricultural development with emphasis on indigenous practices and resources. Sustainability and indigenous practices were focused especially by the research and the extension department (Millar, 2004). Even with this, very limited practical demonstrations or opportunities existed for the smallholders to realize their potentials, which is crucial.

The goal of the Ministry of Food and Agriculture (MOFA) has been to create an environment for sustainable growth and development in the sector. In line with this goal, policies and programmes since the 1990s have been formulated and guided rigidly by the Medium Term Agricultural Development Programme (MTADP) which was geared towards institutional reforms. It aims at shifting attention to smallholder with emphasis on indigenous practices and resources. Based on the MTADP, the Accelerated Agricultural Growth and Development Strategy (AAGDS) was formulated. The AAGDS has, however been silent on the indigenous knowledge of farmers (Government of Ghana/MOFA, 2002). The Food and Agricultural Sector Development Policy (FASDEP) in all recognizes donor conditionalities and the dwindling nature of external funding for agricultural programmes/projects and thus advocate for the effective and efficient utilization of available resources. It failed, however, to explicitly capture indigenous knowledge (IK) as a resource which is abundant in the smallholder. IK has not been captured in areas of intervention identified in both FASDEP 1 and 2. Technology development is quite vivid in MOFA's mission statement and the appropriateness of this developed technology should be vigorously pursued since it is crucial to farmer acceptance and adoptation. Warren and Rajasekaran (1993:1) acknowledge this in their

assertion that "Indigenous knowledge in Third World agriculture is considerable and too often overlooked".

The development efforts of governments (of Ghana) especially in the agricultural sector have been tremendous (FASDEP, 2002) but without much success (Millar, 1992). Effective and efficient utilization of available resources has been advocated. This calls for efficient collaboration of all stakeholders (policy makers, implementers and farmers). The potential (resourcefulness) of each of these stakeholders should not be underestimated.

The developed technology would be appropriate and well fitting to the local conditions if it is grounded on indigenous knowledge systems. According to the World Forum on Food Sovereignty (Spore, 2007:1) "people have the right to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agricultural systems". This is with particular reference to the smallholders who are endowed with indigenous knowledge.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

Methodology is regarded as offering the research principles which are related closely to a distinct paradigm translated clearly and accurately down to guidelines on acceptable research practices (Sarantakos, 1998). For any research project, researchers must have a detailed plan before beginning. The plan should include a conceptualization of the overall organization of the project and a detailed specification of the steps required for successful execution of the research.

Research methodology is thus an important component of any study and provides the framework upon which the whole process is held (Brown, 1996). From the foregoing, one can safely conclude that methodology is the "rule of the game" which constrains the past, the present, and the future of a particular research process.

It is therefore vital that the methodology applied is sound and conducted meticulously to arrive at accurate and precise data in other to achieve the research goals and objectives. This section therefore, provides the framework upon which the research goals and objectives would be achieved. I have therefore provided a detailed explanation of the research approach and process, methods of data collection, sampling procedure, size and methods, background of the study area, and data analysis. The research approach will now be discussed in the next section.

3.2 RESEARCH APPROACH

The two main approaches to data collection and analysis are qualitative and quantitative (Osuala, 2005; Twumasi 2001; Brown 1996; Brannen, 1992). The investigator's methodological choices are always informed by his/her theoretical and philosophical position and the objectives of the study. Sometimes the 2 approaches are presented as if they were in binary opposition to one another. However, they can be used to complement one another and this study has sought to combine the two. The most important difference

is the way in which each tradition treats data. While quantitative research mainly involves surveys and experiments for data collection and mathematical analysis and presentation of issues in the form of percentages, tables and distributions etc, qualitative research is more explanatory and descriptive (Sarantakos, 1998). The central issue that confronts social science research is the choice of the appropriate research approach and methods to investigate the specific problem (Bacho, 2001).This goes to support the view that social issues are varied phenomenon and difficult to capture for investigation. The reason for this lies in the nature of social phenomenon and the objective of the study. As to the type of research approach to use opinions are divided.

Proponents of the quantitative approach argue that human behaviour in the social sciences, just as physical phenomena in the natural sciences, is quantifiable in attributes and subject to generalization that have universal applicability (Bacho, 2001). A quantitative approach is one in which the investigator primarily uses postpositivist claims for developing knowledge - that is cause and effect thinking, reduction to specific variables and hypotheses and questions, use of measurement and observation, and the test of theories (Creswell, 2003). Thus in quantitative research the aim is to determine the relationship between one thing (an independent variable) and another (a dependent or outcome variable) in a population. Quantitative research designs are either descriptive or experimental. A descriptive study establishes only associations between variables. An experiment establishes causality. They further argue that in a quantitative tradition, the instrument is a predetermined and timely tuned technological tool which allows for much less flexibility, imaginative input and reflexivity. Brown (1996) concludes that, where the research issue is clearly defined and the questions put to requires unambiguous answers, a quantitative approach may be appropriate.

A qualitative approach is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives - the multiple meanings of individual experiences, meanings socially and historically constructed, with an intent of developing a theory or pattern (Creswell, 2003). Thus the analytic inductive social sciences argue that the quantitative researcher looks through a narrow lens at a specified set of variables

while the qualitative researcher looks through a wider lens, searching for patterns of interrelationships between a previously unspecified set of concepts (Bonye, 2007).

Those who call for qualitative approach insist that since human judgment is so profoundly a part of every human act, the supposed objectivity of the quantitative approach is a delusion (Osuala, 2005). Thus where the research issue is less clear-cut and the questions to respondents likely to result in complex, discursive replies, qualitative methods are appropriate. As already intimated there are probably no ideal situations of exclusively "qualitative" and "quantitative" data. One might use qualitative data to illustrate or clarify quantitatively derived findings; or, one could quantify demographic findings or, use some form of quantitative data to partially validate one's qualitative analysis (Strauss and Corbin, 1990). Therefore, the two primary goals for both quantitative and qualitative studies are to maximize both response and accuracy (Walonick, 1993).

In the light of the above arguments it is safer to argue for a research situation that could combine the two approaches without ignoring completely the other. This is what this study has sought to do to achieve a fair representation of the study results from the different background of respondents. The research process that was used in the study will now be outlined.

3.3 THE RESEARCH PROCESS

The research process is the procedure through which the study would be conducted. It presents the systematic process of the research right from the start to the end.

The research process started with the identification and definition of the research problem which premised that agricultural extension services are not meeting the needs of smallholder farmers. Hence, the research questions and objectives were shaped in this regard. Literature was then critically reviewed taking into consideration the research questions and objectives. Literature focused on the theoretical and conceptual

explanations and discussions of agricultural extension and farmer innovation. This is followed by the research design which informed my choice of study-survey. Subsequently, data collection was conducted in three phases: reconnaissance phase, main survey phase and an in-depth survey phase. This then paved the way for data analysis and recommendations for policy challenges and development considerations. The theoretical relevance has been informed by literature reviewed on the subject under investigation.

3.4 RESEARCH DESIGN

A research design according to Bryman (2008) provides a framework for the collection and analysis of data. Many authors have categorized research design as either descriptive or causal. Descriptive or cross sectional studies are meant to answer the questions of who, what, where, when and how. Causal studies on the other hand are undertaken to determine how one variable affects another (Walonick, 1993). The selection of an appropriate research design is crucial in order to arrive at valid findings. Hence, the research design that was adopted for the study is the Non-experimental descriptive or Survey Research Design (Brown, 1996; Yin, 1993). The survey is the most common method of gathering information in the social sciences (Bryman, 2008; Babbie, 2007). Survey research studies both large and small populations to discover the relative incidence, distribution, and interrelations of variables. It relies upon the questioning of a selective group (sample) of a population and analysing data in other to answer a hypothesis or describe set characteristics (Babbie, 2007; Saunders et.al., 1997; Walonick, 1993).

Some of the advantages in using this research design as underlined by Brown (1996) are: The collection of large amount of data is quick and cheap; can be used to acquire retrospective information; generalisation of data to the population is possible; it's possible to make comparison of individual and assessment of relationships of variables and data is also collected from a large cross- section of respondents which would have been difficult to collect by other methods.

It is in the light of the above that the survey approach has been adopted in this study. Two main survey research instruments - questionnaires (analyzed using SPSS) and interviews were used to collect data. Questionnaires were administered to farmers (male and female), formal institutions (MOFA, PAS Garu, and ZOVFA) and other individuals on issues in relation to extension services. Questionnaire is an instrument specifically designed to elicit information that is useful for analysis (Babbie, 2007). In-depth interviews and case studies were conducted on the non-formal institutions (farmer groups, traditional leaders, focus groups, etc) on groups and individual basis where it was deemed appropriate. Participant Observations was however, selectively applied in the data collection. This was made during interviews and questionnaire administrations to collect information that otherwise cannot be captured by questionnaires. Details of these have been outlined in the method of data collection. As a start, secondary data was reviewed from earlier work done in books, journals, magazines etc in relation to the subject matter.

3.5 THE STUDY LOCATION

3.5.1 Garu Presbyterian Agric Station

The Garu Presbyterian Agricultural Station was officially established in 1967 by the Presbyterian Church of Ghana to work towards improving the living standards of the people in the area. The station has since been engaged in agricultural extension and community development. The working area of the station covers almost the entire Garu-Tempane District and part of the Bawku Municipal Assembly.

Mission and Goals

The station exists to promote equitable and sustainable income and food security through the provision of integrated agricultural extension services to the farming communities around Garu-Tempane District and Bawku Municipality.

There are currently 3 programme or goal areas carved out of the 2009 – 2011 project phase. They are:

Garu CBR, SEND Ghana, World Vision International, ZOVFA, SFMC Ltd, farmers and others.

3.5.2 Background to the study district

The study is located in the Garu Tempane District, which is on the Southeastern corner of the Upper East Region. It was carved out of the Bawku East District in 2003 and shares borders with Bawku Municipal to the north, Bunkpurugu- Yunyio District to the south, Bawku West District to the west and the Republic of Togo to the east.

According to the 2000 population census there were 113, 333 people in the district. This was projected to 121, 062 in 2006 using a growth rate of 1.1%. The district has a population density of 99 persons per sq km and an average household size of 7(GTDA, 2007).

The Garu Tempane district is part of the interior continental climatic zone of the country characterized by pronounced dry and wet seasons. The dry season is influenced by the dry and dusty Harmattan that blows across the area from November to March from the northeast direction. Rain fall is entirely absent and humidity is very low at 20% during the day and may rise up to 60% in the night. Temperatures swing between 15°C and 38°C. The wet season is influenced by the deep tropical air mass providing rains to the district. Total rainfall is between 800-900mm per annum. The vegetation is mainly of the Sahel Savannah type, consisting of open savannah with fire swept grassland and scattered trees.

The district is covered with 3 main soil types. There is the red and brown sandy loam associated with hornblende granular; the moderately deep pale brown coarse sandy loam associated with biotitic granites and grey sandy loams and clays in river valleys. These support agricultural activities in the area. The district has a 5 divisional chiefs and a sub divisional chief who are the custodians of culture. They support in the administration of justice, mobilization of the people for development and maintenance of security.

The predominant ethnic groups include Kusasi, Bimoba, Bissa, and Moshi. The tribes coexist and intermarry without any serious problems. Annual festivals celebrated in the district include the Samanpiid festival of the Kusasi, the Zisara of the Kusasi and Bimoba and the Danzuor of the Bimoba. During these festivals there is merry making, traditional sacrifices and fund raising activities to support development initiatives mostly on education.

Apart from the followers of the traditional African Religion who constitute the majority, there are Moslems, Christians comprising of Catholics, Presbyterians, Assemblies of God, Pentecost and other denominations.

The study communities include the following:

1. Gozesi
2. Burankuon
3. Siigure
4. Nisum
5. Tankpasi
6. Kugsabilla
7. Bianboog
8. Nanboko
9. Targanga
10. Kugrasian

3.6 SAMPLING METHOD AND SAMPLE SIZE

Sampling is that part of statistical practice concerned with the selection of individual observations intended to yield some knowledge about a population of concern, especially for the purposes of statistical inference. Each observation measures one or more properties of an observable entity enumerated to distinguish objects or individuals (Brown, Cozby, Kee & Worden, 1999). In research the rationale is to make generalization or to draw inferences based on samples about the parameters of population

from which the samples are taken (Yin, 1993). Hence, Miller (1991) concurred that the researcher needs to select only few items from the universe for his study purposes. He further argued that a study based on a representative sample is often better than one based on a larger sample or on the whole population for there is no need interviewing large number of people saying the same thing.

The question of how large a sample should be is a difficult one. In general, sample size depends on the nature of the analysis to be performed, the desired precision of the estimates one wishes to achieve, the kind and number of comparisons that will be made, availability of time and resources, the number of variables that have to be examined simultaneously and how heterogeneous a universe is sampled (Bryman, 2008; Brown, 1996).

The size of a sample should neither be excessively large, nor too small. It should be optimal. While deciding on the size of a sample, the researcher must determine the desired precision and also an acceptable confidence level for the estimates (Saunders et al., 1997). An optimal sample is one which fulfils the requirements of efficiency, representativeness, reliability and flexibility.

The sample size that was chosen for this study was thus guided by the size of the population, the specific population parameters of interest and the cost of the study. In the light of the above, the two main sample techniques - Probability sampling and Non-probability sampling (Twumasi, 2001) were used for the study.

A probability sampling scheme is one in which every unit in the population has a chance of being selected in the sample, and this probability can be accurately determined. This makes it possible to produce unbiased estimates of population totals, by weighting sampled units according to their probability of selection. Examples include simple random and cluster sampling, which the study used. This technique was chosen because it ensures according to Yin (1993) the law of statistical regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe.

It is often however, impossible to do strict probability samplings in the field because other alternatives are appropriate under different circumstances (Bryman, 2008). In some cases for instance respondents chosen for questionnaire administration had to be replaced because they were not available.

Non probability sampling is any sampling method where some elements of the population have no chance of selection or where selection probabilities cannot be accurately determined. Either of these conditions places limits on how much information a sample can provide about the population. The Non-probability sampling such as the "snowball sampling" "deliberate sampling", "purposive sampling" or "judgmental sampling" procedures were also used, although they do not offer any basis for estimating the probability that each item in the population has been included in the sample. In this sampling procedure, the researcher purposively chooses the particular units of the universe to constitute the sample on the basis that the small mass that they so select out of a huge one will be typical or representative of the whole (Yin,1993). Thus, the judgment of the researcher plays an important part in this sampling technique. The importance of adopting this design by researchers is the relative advantage of time and money inherent in the sampling. This is also so when the primary interest of the researcher is in understanding qualitative and rational issues other than quantitative problems pertaining to how, how often or to what degree a particular attribute or characteristic is distributed (Bernard, 1990).

Given this background, information needed is specialised with respect to the identification of the various stakeholders, hence, purposive sampling technique was used to identify community volunteers, key actors and village specialists.

Most behavioural and social science studies use convenience samples consisting of students, paid volunteers, patients, prisoners, or members of friendship networks or organizations. Studies with such samples are useful primarily for documenting that a particular characteristic or phenomenon occurs within a given group or, alternatively,

demonstrating that not all members of that group manifest a particular trait. Such studies are also very useful for detecting relationships among different phenomena (Fowler, 1984).

In the light of the above discussions the samples for the study were carefully taken. The District under study is composed of 195 communities of which the Presbyterian Agricultural Station provides extension services in over 50 communities. The 50 communities are divided into four (4) zones. Four (4) communities were randomly sampled, one (1) from each zone. Another set of four communities were also chosen at random from a list of communities where MOFA is active. Two other communities were added where ZOVFA is active. Thus a total of ten (10) communities were selected and twenty (20) farmers (both men and women) interviewed at random. However, no one sex was to exceed 12 persons (or 60%) of the people interviewed in each community. In all 200 community members were interviewed – 114 men and 86 women.

Table 3.1: The sampling process

Activity	Results
1. Identification of communities in the Garu Tempane District	195 communities
2. Clustering of communities based on extension providers' zones	3 clusters
3. Random selection of Communities from clusters	10 communities
4. Selection of 20 respondents (men & women) per community	200 respondents

Source: Self construct

Fifteen to twenty (15-20) community members were purposively identified and interviewed as a group. The discussion centred on the following themes:

- Their involvement with extension agents
- Their capacity to come out with innovations
- The effectiveness of extension services

It is in the light of the above that the survey approach has been adopted in this study. Two main survey research instruments - questionnaires (analyzed using SPSS) and interviews were used to collect data. Questionnaires were administered to farmers (male and female), formal institutions (MOFA, PAS Garu, and ZOVFA) and other individuals on issues in relation to extension services. Questionnaire is an instrument specifically designed to elicit information that is useful for analysis (Babbie, 2007). In-depth interviews and case studies were conducted on the non-formal institutions (farmer groups, traditional leaders, focus groups, etc) on groups and individual basis where it was deemed appropriate. Participant Observations was however, selectively applied in the data collection. This was made during interviews and questionnaire administrations to collect information that otherwise cannot be captured by questionnaires. Details of these have been outlined in the method of data collection. As a start, secondary data was reviewed from earlier work done in books, journals, magazines etc in relation to the subject matter.

3.5 THE STUDY LOCATION

3.5.1 Garu Presbyterian Agric Station

The Garu Presbyterian Agricultural Station was officially established in 1967 by the Presbyterian Church of Ghana to work towards improving the living standards of the people in the area. The station has since been engaged in agricultural extension and community development. The working area of the station covers almost the entire Garu-Tempane District and part of the Bawku Municipal Assembly.

Mission and Goals

The station exists to promote equitable and sustainable income and food security through the provision of integrated agricultural extension services to the farming communities around Garu-Tempane District and Bawku Municipality.

There are currently 3 programme or goal areas carved out of the 2009 – 2011 project phase. They are:

- The role of various stakeholders in agricultural issues
- Their suggestions on improving agricultural extension

This however, was combined with PRA tools where the researcher engaged discussions with groups (men, women and both) and individuals in critical arenas (de Vries, 1991) where necessary. These tools have been discussed under the data collection techniques. Information was also collected from government agencies such as MOFA and NGOs operating in the district pertaining to their role and involvement in extension delivery. Samples of eighteen (18) governmental and non-governmental agencies' officials have been interviewed. In all 218 questionnaires were administered.

3.7 DATA COLLECTION APPROACH.

There are two major approaches used in social research in gathering data (Miller, 1991). These are the Primary and Secondary sources. It is, however, important to note that the selection of a particular approach to collect data must be decided upon in the light of one's problem, the purpose of the study, the resources available and the skills of the researcher. In selecting a method for data collection, the socio-economic-demographic characteristics of the study population play an important role. Some population for a number of reasons, may not feel either at ease with a particular method of data collection or comfortable to express opinions in a questionnaire for example. Therefore, in making a decision on the type of data collection method, the researcher must keep in mind the type of people he is dealing with, the nature of the social situation, the mood of the social environment and the psychology of the people (Grady, 1998).

Accordingly, it is necessary for the researcher to use more than one method in data collection. In the light of the above discussion data was collected from primary sources through interviews, observation and questionnaires. While secondary data obtained through documentary sources such as books, journals, magazines, internets and other earlier researches on the subject matter. Details of how the data collection approach was applied in the research are outlined below.

3.7.1 Interviews

Kuma (1996: 109) defined interview as "any person-to- person interaction between two or more individuals with a specific purpose in mind". It is an alternate method of collecting survey data where the researcher asks the questions orally and record respondents' answers (Babbie, 2007). Interviews are classified into structured and unstructured. The two classifications were used in this study. In using the unstructured interview approach, also known as the in-depth interview, a framework was developed to guide the interview process. The rationale for using this approach was to enable me effectively engage with groups of respondents within which questions can be formulated and asked spontaneously as the interview progressed. This approach enabled the respondents to freely express their opinion. This therefore, supports Yin's (1993) view that a good interview is one in which the interviewee takes over the control of the interview situation and talk freely. This approach was therefore intended to allow respondents to speak freely on services they have received over the years and the extent to which farmers' innovations have been solicited, enhanced or promoted. It afforded the interviewee the opportunity to clarify any issues that were not understood and therefore made the responses more relevant and accurate (Babbie, 2007; Kreuger and Neuman, 2006). Moreover, the researcher will be able through this method to observe things to understand the context within which the answers were given.

However, the issue of interviewer bias has been cited by authorities like Kreuger and Neuman (2006) as the deviation from the true responses defined in terms of the purpose of the study. This has been minimised through training of interviewers and pre testing of interview guide and instruments.

3.7.2 Questionnaire

Questionnaires are an inexpensive way to gather data from a potentially large number of respondents. It is a written list of questions, the answers to which are recorded by

respondents. Often they are the only feasible way to reach a number of reviewers large enough to allow statistical analysis of the results. Twumasi (2001) sees questionnaire as an efficient method of data collection because several respondents can be reached within a short time.

The respondents therefore read the questions, interpret what is expected and then write down the answers. The questionnaire approach was adopted and used. Saunders, Lewis and Thornhill (1997) argued that the choice of using a questionnaire will be made based on a variety of factors including the type of information to be gathered and the available resources for the experiment. A questionnaire should be considered in the following circumstances.

- When resources and money are limited. A Questionnaire can be quite inexpensive to administer. Although preparation may be costly, any data collection scheme will have similar preparation expenses. The administration cost per person of a questionnaire can be as low as postage and a few photocopies. Time is also an important resource that questionnaires can maximize.
- When it is necessary to protect the privacy of the participants. Questionnaires are easy to administer confidentially. Often confidentiality is necessary to ensure participants will respond honestly if at all.
- When corroborating other findings. In studies that have resources to pursue other data collection strategies, questionnaires can be a useful confirmation tools. More costly schemes may turn up interesting trends, but occasionally there will not be resources to run these other tests on large enough participant groups to make the results statistically significant. A follow-up large scale questionnaire may be necessary to corroborate these earlier results.

- Importance of respondents' answers not being contaminated or distorted;
- Size of sample required for analysis, taking into account the likely response rate;
- Type of questions you need to ask to collect data and;
- Number of questions you need to ask to collect your data

In the light of the above the choice of the questionnaire method was based on the fact that some of the target respondents are literate. Therefore, self-administered questionnaires were used to elicit information from heads and staff of formal institutions such as MOFA, PAS Garu and ZOVFA who are engaged in extension service provision. On the other hand interviewer-administered questionnaire were conducted on the non-literate respondents who are mainly farmers and community members.

3.7.3 Observation

Kuma (1999) defined observation as a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place without asking the respondent. He further outlined the basic conditions under which it is most appropriate to observe as: learning about interactions, functions and behaviours in a group. This is more so, relevant in situations where accurate information cannot be elicited by questioning. This approach was relevant in obtaining data during preliminary visits and focus group discussions with community leaders, experts and group leaders.

3.7.4 Secondary sources

The purpose of a literature review is for the researcher to take a critical look at the literature that already exists in the area he/she is researching. A literature review is not a shopping list of everything that exists, but a critical analysis that shows an evaluation of the existing literature and a relationship between the different works. It demonstrates the relevance of the research.

Secondary sources include books, journal articles, internet, newspapers, magazines, theses and dissertations, conference proceedings, reports, and documentaries. Literature review has been core in the whole process of this research. It has enabled me to acknowledge the contributions of earlier works and also to chart a way forward in all stages of the research. As such, I have reviewed many magazines, books, journals, and the internet among others on the subject matter.

3.7.5 Stages of Data Collection

The study has been conducted in three stages: the reconnaissance survey, main survey and in-depth survey. In these phases, data was collected on the provision of extension services by both private and public institutions.

The study started with the Reconnaissance Survey. This phase involved the selection of communities where the main survey was conducted. Communities were visited to familiarise, establish linkages and rapport, and build relationships with the relevant persons and institutions. Relevant institutions like MOFA, well as ZOVFA and farmer groups in the district also identified and contacted. Community experts in various fields such as livestock, crop management, etc were also identified. It is in this phase that secondary information was sourced and reviewed. This then led to the Main Survey phase.

In the Main Survey phase, the focus was to collect data on how agricultural extension services are being accessed. Households were randomly selected and interviewed using questionnaire. Staff members of relevant institutions like PAS Garu, MOFA, and other NGOs like ZOVFA also filled the questionnaire.

In depth interviews were carried out for selected groups and individuals. The groups included community leaders, experts and farmer group leaders. The last phase, the In-Depth study was to deepen understanding of specific issues that came up in the previous two phases. In this study, supplementary information was collected through the use of Case Studies and discussions. Follow up visits were made especially to MOFA, PAS Garu and ZOVFA.

3.8 DATA ANALYSIS

Kuma (1999) referred to data analysis as the computation of certain measures along with searching for patterns of relationship that exist among data-groups. In analysing data in general, Yin (1993) also concurs that a number of closely related operations are performed with the purpose of summarising the data collected and organising them in

such a manner that they answer the research question. The data analysis has employed both qualitative and quantitative (SPSS) approaches to examine key issues at stake. Chi-square analysis was used where applicable to determine the relationship between variables in the study.

In view of the above, qualitative data analysis was made at the same time during the data collection process and after the overall data was collected. This goes to support the view of Yin (1993) that data analysis should not be a separate step coming after data collection but a continuous and simultaneous process. However, the SPSS analysis was done later in the office and inferences cross-checked in the field.

In the data collection process, qualitative field notes captured on daily basis on historical events, conversations, interviews and stories on farmer innovations, extension service delivery systems and providers captured during group discussions and interactions with key informants was analysed after the day's work. The rationale was to keep track of important events/ issues that crop up in the days work and prepare adequately for the next day. It was also to look for consistencies and inconsistencies between knowledgeable informants and find out why informants agree or disagree on important issues on the subject matter (Bernard, 1990).

In quantitative analysis, simple quantitative operations from questionnaires have been tabulated and processed using SPSS. The use of graphs, charts, frequencies, and averages will attract statistical considerations using SPSS (Brown, 1996). The overall data analysis has been a combination of the two approaches - qualitative and quantitative.

CHAPTER FOUR: FINDINGS AND DISCUSSIONS

4.1 SOCIO- DEMOGRAPHIC CHARACTERISTICS

4.1.1 Introduction

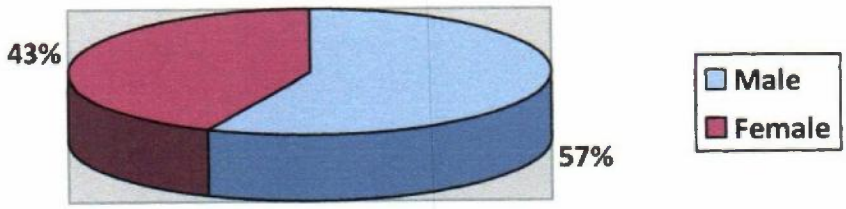
This section presents the socio demographic characteristics of the respondents. They were made up 200 farmers selected from ten (10) communities and 18 extension officers from the Ministry of Food and Agriculture, Garu Presbyterian Agric Station (PAS Garu) and Zuure Organic Vegetable Farmers Association (ZOVFA). The study communities include the following: Gozesi, Burankuon, Siigure, Nisum, Tankpasi, Kugsabilla, Bianboog, Nanboko, Targanga and Kugrasian.

Given the two different sets of data in the report, the term 'respondents' is used to refer to the views expressed by farmers. Any reference to field or extension officers will be specified as such. The relevant aspects of the socio demographic characteristics include: sex and age distribution, occupation, marital status, religion and education of the respondents.

4.1.2 Sex and age of respondents

Figure 4.1 shows the sex composition of respondents. In all 200 farmers were covered. They comprised of 114 men (representing 57%) and 86 women (representing 43%). They were selected from 10 communities across the Garu Tempane District.

Figure 4.1: Sex distribution of respondents



Source: Field survey 2009

As captured in Table 4.1, the various age groups have been fairly represented. Of the 200 farmers interviewed 45 (22.5%) are 35 years and below; 65 (32.5%) between age 36-45; 39 (19.5%) are between 46-55 years and 51(25.5%) are above 55 years. Clearly, majority of the respondents are in the active working group 36 to 45 years of age. However, there is a fair representation of youth as well as the experienced ones.

Table 4.1: Age distribution of farmers by sex

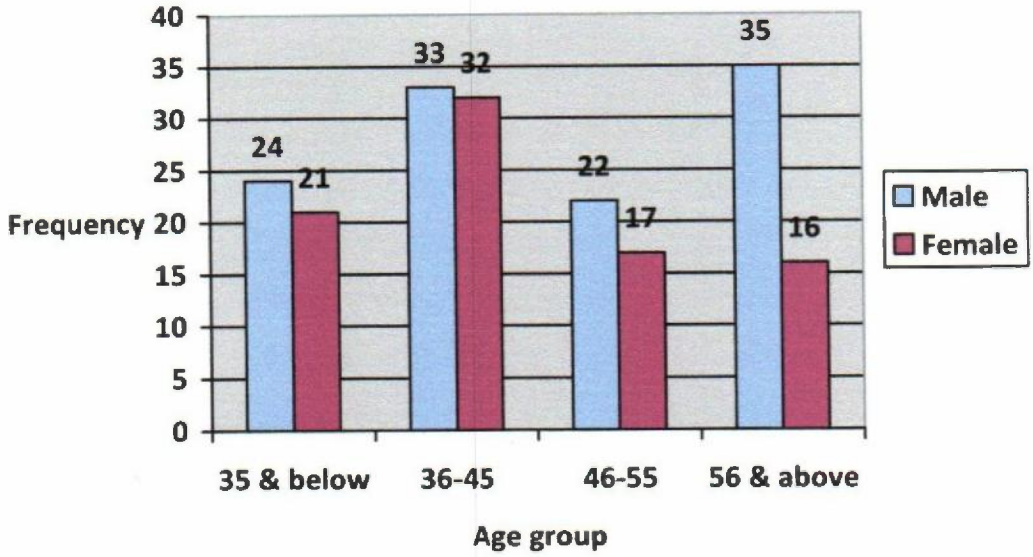
Sex	Age group of respondents				Total
	35 & below	36 – 45	46 - 55	56 & above	
Male	24	33	22	35	114(57)
Female	21	32	17	16	86(43)
Total	45(22.5)	65(32.5)	39(19.5)	51(25.5)	200(100)

Chi square test: P=0.251

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

From the table it is also clear that more young women were covered in the study than men. A total of 53 women (representing 61.6%) were 45 years or below while 56 men (representing 50%) were in the same age bracket. However the use of chi-square indicates no significant difference (P = 0.251) between the sex and age of respondents.

Figure 4.2: Age distribution of respondents



Source: Field survey 2009

On the part of extension officers, 18 persons were interviewed; 13 (72.2%) and 5(27.8%) are male and female respectively. A closer look at the data indicates that majority of male officers are 36 years above (69.2%) while majority of female officers (60%) are below this mark (36). Thus whereas the male officers are on their way out (that is to retirement), the females are now getting into the profession. This is a hopeful situation if the trend continues.

Table 4.2 Age distribution of extension officers by sex

Sex of Extension Officer	Age of Extension Officer				
	15-25	26-35	36-45	46-55	Total
Male	0(0%)	4(30.8)	7(53.8)	2(15.4)	13(100.0)
Female	2(40.0)	2(40.0)	0(0)	1(20.0)	5(100.0)
Total	2(11.1)	6(33.3)	7(38.9)	3(16.7)	18(100.0)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

4.1.3 Marital status

Majority of farmers interviewed were married. 175 persons representing 87.5% of them were married. 20 farmers (16 of them being women) representing 10% were widowed whiles 5 persons (all male) representing 2.5% were single or had never married at the time of the data collection.

Table 4.3 Marital status and Sex of respondents

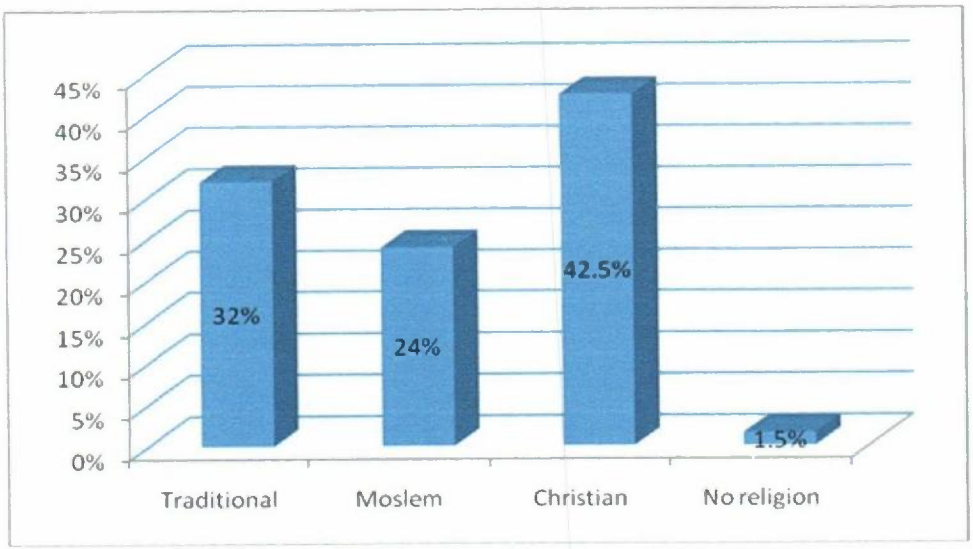
Marital status	*Sex of respondent*		*Total*
	Male	Female	
Married	105	70	175 (87.5)
Never Married	5	0	5 (2.5)
Widowed	4	16	20 (16)
Total	114	86	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

4.1.4 Religious inclination of respondents

The religious inclination of respondents makes interesting reading. As captured in figure 4.3, 64 persons (representing 32%) indicated that they were loyal to the Traditional African Religion; 48 (i.e. 24%) said they were Moslems; 85 (42.5%) said they were Christian and 3 (1.5%) said they did not belong to any religion or denomination. This confirms the general belief that most of the communities in the study area are now dominated by foreign religions: Christianity and Islam, as the two together take up 66.5% of respondents.

Figure 4.3: Religious inclination of respondents



Source: Field survey 2009.

4.1.5 Level of Education and main occupation

It is evident from Table 4.4 that majority of respondents, indeed 154 (representing 77%), do not have any formal education. The gender disaggregation of the figures is more revealing as it epitomizes the gender disparities that characterize the study area and the north in general (Karbo and Bruce, 2003; Atengdem and Dery, 1998). As captured on the table below, 91.9% of female respondents did not have access to formal education

compared to 65.8% male respondents. Comparing the levels of education between male and female respondents, it is evident that only 1 female respondent (1.2%) went beyond primary school whereas 19 or 16.7% of males achieved the same level.

Table 4.4 Sex and level of education of farmers

Sex	Level of education				Total
	Primary	Middle/JHS	Vocational & above	Not educated	
Male	20 (17.5)	14 (12.3)	5 (4.4)	75 (65.8)	114 (100)
Female	6 (7.0)	0 (0.0)	1 (1.2)	79 (91.9)	86 (100)
Total	26 (13.0)	14 (7.0)	6 (3.0)	154 (77.0)	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

Extension Officers were asked to indicate their highest level of education. Table 4.5 says it all. 5 persons representing 27.8% had first degree, 4 persons representing 22.2% had each completed Senior High and Masters, 3 had completed Polytechnic and 2 finished college. Interestingly all masters holders were males. From the data, almost 60% of male officers had either a first degree or master while that of females is 40%. This is another manifestation of the gender disparity in the area of extension service provision.

Table 4.5: Level of education of Field officers by sex

Highest level of education	Sex of field officer		Total
	Male	Female	
SHS	4(30.8)	0(0)	4(22.2)
College	0(0)	2(40)	2(11.1)
Polytechnic	2(15.4)	1(20.0)	3(16.7)
First Degree	3(23.1)	2(40.0)	5(27.8)
Masters	4(30.8)	0(0)	4(22.2)
Total	13(100.0)	5(100.0)	18(100.0)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

Respondents were also requested to indicate their main occupation. As expected almost all of them said farming is their main source of livelihood. Interestingly, all the 86 women said farming is their main occupation. Three (3) males did not regard farming as their main occupation. Two (2) of the males said trading is their main occupation and the other said he was schooling.

Table 4.6: Occupation and sex of respondents

Main occupation	Sex of respondent		Total
	Male	Female	
Farming	111 (97.4)	86 (100)	197 (98.5)
Trading	2 (1.8)	0 (0)	2 (1.0)
Other	1 (0.9)	0 (0)	1 (0.5)
Total	114 (100)	86 (100)	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

4.1.6 Membership of farmer groups

The study sought to find out who belong to farmer groups. Out of the 200, 115 (57.5%) were members of farmer groups while 85 or 42.5% were not. A gender disaggregation reveals that more men are in groups than the women contrary to the notion in the area that more women are in groups than the men (PAS Garu, 2008).

Table 4.7: Membership of farmer groups

Do you belong to a farmer group?	Sex of respondent		Total
	Male	Female	
Yes	71 (62.3)	44 (51.2)	115 (57.5)
No	43 (37.7)	42 (48.8)	85 (42.5)
Total	114 (100)	86 (100)	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

4.2 FARMING AND COMMUNITY SYSTEMS

4.2.1 Introduction

Understanding the community and farming systems is very critical in assessing the effectiveness or otherwise of agricultural interventions. This section seeks to provide an overview of the community systems that support farming activities in the study area.

The discussions will focus on the findings regarding the type of farms people generally have, the common crops grown, the size of farms kept, the methods of land preparation, sources of labour and how information is passed. I will also outline briefly the traditional systems that are practiced in the study location. In the process I will continue to disaggregate the data by sex where necessary in order to analyse the gender dimensions that are woven in the community system.

4.2.2 Type and size of farms

The majority of farmers interviewed indicated that they engage in both crop and livestock production activities. Table 4.8 captures the data on type of farms. On the whole 152 persons representing 76% say they are into both crops and livestock, 21.5% are into crops only and 2.5% are into livestock only. A closer look at the gender disaggregated figures reveals that most of the people who indicated either crops or livestock are women. Of the 86 women respondents, only 43(or 50%) are into crops and livestock production, 41 (47.7%) are engaged in crops only whiles 2 (2.3%) are into livestock only. This contrasts sharply with the male respondents who have 109 (95.6%) of them engaged in crops and livestock production, 2 (1.8%) in crops only and 3 (2.6%) in livestock only.

Table 4.8: Type of farming practice and Sex of respondent

Type of farming practice	Sex of respondents		Total
	Male	Female	
Crops only	2 (1.8)	41 (47.7)	43 (21.5)
Crops & livestock	109 (95.6)	43 (50.0)	152 (76.0)
Livestock only	3 (2.6)	2 (2.3)	5 (2.5)
Total	114 (100)	86 (100)	200 (100)

Source: field survey 2009. Note: Figures in parenthesis are percentages.

On farm size it is worth noting that the study area is characterized by small land holdings in view of the population pressure (Atengdem and Dery, 1998). Out of the 200 farmers interviewed 107 or 53.5% have farm sizes of between 1 and 4 acres. However, 76 of the persons in this category are women. Indeed 88.4% of the women have farm sizes within this range. Table 4.9 also shows that 65 respondents or 32.5% of respondents have farm sizes of between 5 to 8 acres. This category is dominated by men as they constitute 57 out of 65 (representing 87.7%).

Table 4.9: Sex and farm size of respondents

Farm size	Sex of respondent		Total
	Male	Female	
1-4 acres	31 (27.2)	76 (88.4)	107 (53.5)
5-8 acres	57 (50.0)	8 (9.3)	65 (32.5)
9-12 acres	21 (18.4)	2 (2.3)	23 (11.5)
12 + acres	5 (4.4)	0 (0.0)	5 (2.5)
Total	114 (100)	86 (100)	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

The indication is that whereas the average farm size of men is between 5 to 8 acres that of the women is between 1 to 4 acres. This is in conformity with the contention of Van Huis and Meerman (1997) that most farmers in sub-Saharan Africa have small holdings of less than 2 ha in West Africa using traditional techniques to produce the bulk of the food.

4.2.3 Land preparation and Labour source

Land preparation is usually carried out at the onset of the rainy season. From Table 4.10 bullock ridging is the dominant method. 179 or 89.5% out the total respondents indicated they use bullocks to prepare the land. None of the respondents indicated that they use tractor or similar machinery. This confirms findings of studies to the effect that animal traction is extensively used in the area (Blench, 2005; Karbo and Bruce, 2003).

Table 4.10: Method of land preparation

Method	Frequency	Percent
Hoe (sok)	21	10.5
Bullock ridging	179	89.5
Total	200	100.0

Source: Field survey 2009

On sources of labour, respondents were asked to indicate their most important source of labour as can be seen in Table 4.11. It is clear that the family is the most important source of labour in the study area as 124 respondents or 62% say they get their main labour from that source. Hired labour has also become important, taking 28% of the sources.

Table 4.11: Most important source of labour

Labour source	Frequency	Percent
Family	124	62.0
Hired labour	56	28.0
Friends	11	5.5
Group members	9	4.5
Total	200	100.0

Source: Field survey 2009

4.2.4 Crops and livestock

Farmers were requested to indicate the main crops that they grow. Also on the guide for focus groups discussion, to mention the type of livestock they keep. The common ones that were mentioned include millet, sorghum, maize, soybeans, rice, groundnut and cowpea. Onion and pepper were also mentioned for dry season gardening. It is to be

noted that the study area is noted for dry season activities (Karbo and Bruce, 2003; Atengdem and Dery, 1998). On the part of livestock, respondents mentioned during focused group discussions that they rear poultry (including guinea fowl), small ruminants (sheep and goats), pigs and cattle.

4.2.5 Nature of information flow

Respondents were asked whether they pass on farming information to their fellow farmers. Table 4.12 contains the results of the responses. 94% responded in the affirmative. This is confirmation that farmer to farmer extension is as old as agriculture itself (Millar, 2008). The responses indicate that farmers use every available opportunity to spread information on farming amongst themselves. A study in Benin found that the lives of farmers involved in a farmer field School were "deeply integrated into village society because of their lineage and connections. These individuals actively passed on the knowledge they had acquired to their wives, uncles, parents-in-law, friends and neighbours" Nathaniels, (2005:4). Most of it is done within the informal setting: Drinking/pito bars, market places, during communal labour, personal contacts, and funerals. Those who belong to groups also make use of group meetings and community meetings to pass on information.

Table 4.12: Passing information to other farmers

	Frequency	Percent
Yes	188	94.0
No	12	6.0
Total	200	100.0

Source: Field survey 2009

4.2.6 Traditional systems

Respondents were requested to indicate any traditional systems that support their farming activities. The first batch of responses were collated and classified and the results are captured in Table 4.13.

Table 4.13: Traditional systems that support farming activities

Description	Frequency	percent
Use of traditional implements	74	39
Use of traditional practices that sustain the farming system	42	22
Traditional treatment systems	25	13
Sacrifices to the gods and ancestors	22	12
Social support systems	20	11
Traditional crops	7	4
Total	190	100

Source: Field survey 2009

The list is in line with discussions held with traditional experts and authorities in the course of the study. It was observed that traditional implements left behind by the immediate ancestors still constitute the main machinery in the farming business. These include the hoe, cutlass and knife. Bullock ploughing though a later addition has not replaced the hoe. The farmers argue that composting is a traditional practice that has been given a new name. Thus the use of household waste and animal droppings to enrich the soil has always been the practice of the farmer to sustain the system.

Respondents also mentioned a wide range of prescriptions for various situations that have been captured as "traditional treatment systems". Some of the things listed were the use of ash for preservation and also as treatment; use of various herbs for treating livestock diseases and traditional arrangements for preventing disease outbreak.

Closely related but separate is traditional sacrifices to the ancestors for protection and for a good harvest. At the beginning of the farming season libation is poured by the family

head calling on the gods and the ancestors to take charge of the farming activities. He will then start the sowing before allowing the other work force (mainly women) to join in or take over the process. Later when the early millet is ready for harvest and consumption a purification ceremony is performed before people are allowed to consume the produce. This practice is repeated during late millet harvest. After the harvest of the rest of the farm produce a thanksgiving sacrifice is held amidst funfair – with pito, sacrifice of a cock and guinea fowls and merry making. This is known as "Samanpiid" for the Kusasi and "Danjour" for the Bimoba. Nowadays, these festivals have taken a new turn with a grand durbar of the chiefs and people where development issues are discussed and taken on board.

This finding is in line with the position of renowned authorities in traditional knowledge systems. Millar (2008:96) contents that "for the people in Northern Ghana gods, spirits, ancestors, spiritual and political leaders, sacred groves, lands and shrines, ritual crops and animal, food items and cash crops are all interrelated". Thus the human world, the natural world and the spiritual world are interlinked. However, the Christian and Moslem farmers said they offer prayers to the Almighty God at beginning of the planting season and then hold thanksgiving when the harvest is completed.

The issue of social support systems was not left out. As was discussed earlier monetization has not replaced family and communal labour in most of the study area. Tied to this is the system of seeking seed from relatives and friends. This system ensures that those who are vulnerable are not left to their fate. Also important is the system of knowledge sharing at pito bars, funerals and festivals.

Finally notwithstanding the introduction and uptake of new crops like maize, soybean and cotton the main traditional crops like early millet, sorghum, late millet and cowpea continue drive the farming system in the area. This is because these crops are used for traditional sacrifices.

4.3 FARMER INNOVATION

4.3.1 Introduction

Farmer innovation is an important component of this research. This area will thus focus on what farmers have introduced, modified or changed to enhance their production activities. The following will be covered under this section: farmers as innovators (which also encompasses the nature of farmer innovation), sources of farmer innovation and the reasons why farmers introduce changes in their farming practices.

4.3.2 Farmers as innovators

Respondents were asked whether they have made any changes in their farming practices over the last 3 years. An overwhelming 91% answered yes. Thus only 18 out of 200 said they did not make any changes in their practices. However, the figure for men respondents is higher (97.4%) than that of women which is 82.6%. This constitutes a plus for women, given the fact that most household and farm level decisions are made by the men (Apusigah, 2004; Ayeh, 1991).

Table 4.14: Changes in farming practices by sex

Sex	Change in practices		Total
	Yes	No	
Male	111 (97.4)	3 (2.6)	114 (100)
Female	71 (82.6)	15 (17.4)	86 (100)
Total	182 (91.0)	18 (9.0)	200 (100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

This particular finding sharply contrasts with the flawed notion that farmers are mere takers of innovation (Gottret 2007). It perfectly corroborates the assertion that when there was no extension services, farmers came up with ideas, carried out experiments and

arrived at their own conclusions (Millar, 2008; Critchley, 2007; Okry and van Mele, 2006). Chambers (1983) supports this assertion when he argued that farmers often achieve a richness of observation and a fineness of discrimination that would be accessible to western scientists only through long and detailed measurement and computation. In the same vein, Ouedraogo and Sawadogo (2005) report that in the Yatenga Region of Burkina Faso, local improvements on a traditional farming technique have become very widespread, largely on account of the innovativeness of farmers in developing their own forms of farmer-to-farmer extension. They have found highly effective ways of spreading their ideas and encouraging other farmers to try them out.

Respondents were also asked to describe the changes they had introduced over the last three years. Here, there were so many varied answers. A summary of the responses have been clustered and classified and are listed in Table 4.15.

As shown on Table 4.15, the highest score of 18.6% is the introduction of new crop varieties. From the Focus group discussion it was said that farmers have resorted to short duration varieties in answer to the changing rainfall pattern. In addition new crops have been introduced altogether. An example is the wide scale cultivation of maize and soybeans in the study area. The next highest score is the planting distances of some crops particularly sorghum, soybean and maize. One farmer mentioned that most of them are now taking plant population density seriously as it is crucial in determining the yields on the farm. The third score in the area of innovation is about manure management. The next type of change is the gathering of crop residue for livestock. Although they used to do it this time the practice has become more widespread. Initially the practice was limited to groundnut vines but now soy stalks, rice straw and even maize stalks are involved. Other areas of change mentioned include early planting and harvesting, crop rotation, growing of water melon, livestock treatment, seed selection, soil/land conservation, dry season gardening and other miscellaneous practices.

Table 4.15: Nature of changes made by farmers

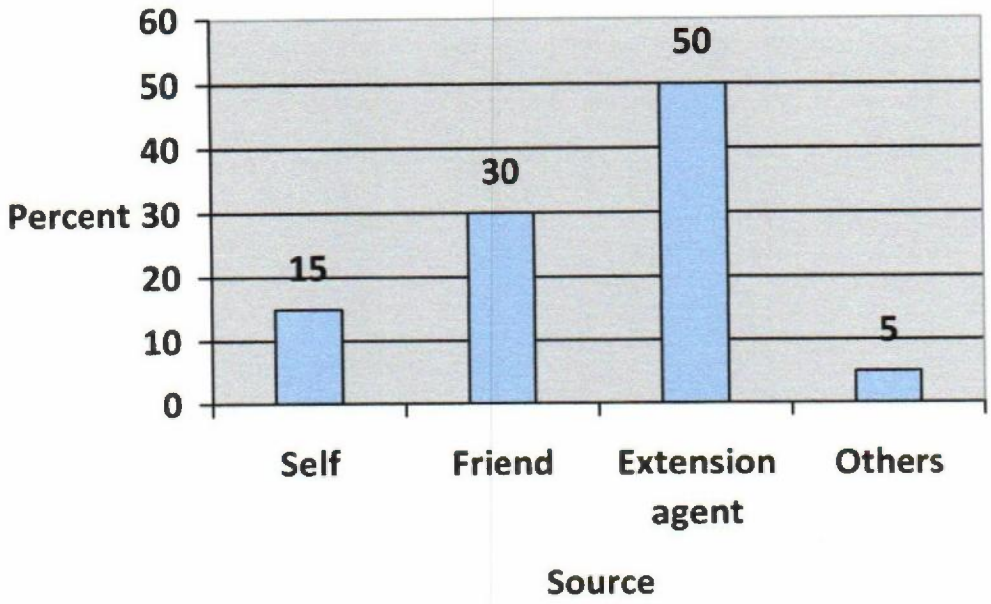
Nature of change	Frequency	Percent
Introduction of new varieties of crops	36	18.6
Planting distance of some crops have changed	28	14.4
Better management and use of manure or organic manure	18	9.3
Gathering crops residue for livestock	16	8.2
I now practice crop rotation	14	7.2
Engage in early planting	12	6.2
Early harvesting time	12	6.2
Growing of watermelon	11	5.7
Animal health care- discovered new treatment for my livestock	10	5.2
Dry season farming	9	4.6
Land conservation	8	4.1
Change of seed	6	3.1
Land preparation methods	6	3.1
Miscellaneous changes	8	4.1

Source: Field survey 2009

4.3.3 Sources of innovation

The study sought to find out the source of the changes that farmers have made over the years. Figure 4.4 tells the story. Here the extension agents scored high marks as 50% attribute the changes to them. Respondents representing 30% trace the source of the knowledge to friends and 15% percent take credit in themselves. During focus group discussions it was explained that although most farmers tend to modify a lot of the technologies introduced by extension officers, they still find it expedient to give the credit to the extension agents.

Figure 4.4: Sources of changes in farm practices



Source: Field survey 2009

During focus group discussions at Kugsabilla, a farmer narrated her source of innovation which is not any of the ones mentioned above. This has been captured in Box 4.1 below.

Box 4.1: Finding a cure for pigs

My name is Janet Abuosi. I was sleeping at night when a figure appeared to me like a human being but had strange arms. He said to me: "why do you let your pig suffer when you can use the bark of the tree behind your house?" I woke up trembling and feeling very weak. The following day I went for the bark of the mahogany tree behind my house and soaked it for three days. I brought it for the pig to drink but it will not. I sprinkled the liquid on its swelling and forced some of it into the mouth of the pig. After some efforts all the pigs started to drink the medicine because I provided it as drinking water. I continued to give the concoction until the swelling gradually disappeared.

4.3.4 Reasons for innovation

Various reasons were given by respondents for engaging in innovation practices. Most of the reasons given are economic. Improving yields and income were the most common. Others said they needed to improve food production and thereby reduce the hunger gap. Some indicated that they just wanted to try for the sake of it. One said he tried a number of options in order to arrive at the one with the best results. This is in line with the view expressed by Millar (2008) that farmers are researchers in their own right.

A lot of the respondents also alluded to the fact that conditions had changed, thereby calling for change as well. Most cited the change in rainfall pattern that call the cultivation of short duration crops. Others have mentioned opportunities provided by change agents such as improved seed, breeds and introduction of new crops.

These findings are in consonance with those of Millar (2008) and Rhoades and Bebbington (1988) that small farmer experimentations could be classified as curiosity, problem solving and adaptive. A typical example of an adaptive trial is provided by a vegetable farmer based at Gelakolog, a community near Garu. Abunkudug Asu'ug who won an award on the 2009 National Farmers' Day as the best District vegetable farmer for that year, shared with the researcher how he used his own knowledge to commence the cultivation of Irish potato. His story is captured in box 4.2 below.

Box 4.2: Cultivation of Irish potato

My name is Abunkudug Asu'ug, a vegetable farmer based at Gelakolog and an award winner in onion production. I cultivate onion, tomatoes, Irish potato, carrots and cabbage. I have cultivated onion for the past 35 years since I was a child. One of my biggest strides in innovation is in relation to the cultivation of Irish potato. The seed was introduced to me by a white priest. He asked me to try it to see whether the crop will grow well in Ghana. He then described how the crop is grown in Europe.

I then used my own knowledge to modify the practices as described to me. After nursing the seed and preparing the ridges as described by the priest, I decided to change the transplanting method. I used a hoe and made a line of about 6 inches deep on the ridges prepared. Then I applied manure on the line before transplanting the seedlings. I applied minimum water until they survived.

At the first harvest the priest was very much surprised. He told me that even in Europe the farmers are not able to get the size of potato I produced. He told me that if I needed the seed I could go to Dapango in Northern Togo. Since then I have been growing Irish potato and I make a lot of money from the crop. I also make money from onion. Last year I got 75 bags from onion alone. The secret to successful farming is commitment, continues presence, care and above all observing and taking note of everything that happens on the farm.

4.4 EXTENSION SERVICES AND APPROACHES

4.4.1 Introduction

This section seeks to outline the findings in respect of extension service provision and the approaches and strategies being applied and how the community members perceive them. The discussion will focus on visits by extension agents, their activities/ intervention areas, the use of farmers' knowledge, how farmers rate the different services and the gaps from both the farmers and extension agents.

4.4.2 Visits by Extension Agents (EA)

The Garu Presbyterian Agric Station, MoFA and other organizations have field Officers who visit farmers to provide advisory services to them. Respondents were asked whether they have been visited by an extension agent (EA). 116 representing 58% answered yes while 84 representing 42% said no. Disaggregating the responses according to sex presents very interesting results. From a cross tabulation and using chi square, there was a very high significant difference between the sex of the respondent and access to visits by EA, P=0.000. Only 4 in every 10 women were most likely to receive visits by EAs. On the contrary, nearly 7 in every 10 men were most likely to receive visits from EA. Send Ghana (2009) presents a gloomier picture as 64.4% of small holder farmers across the country are reported to have no access to extension services.

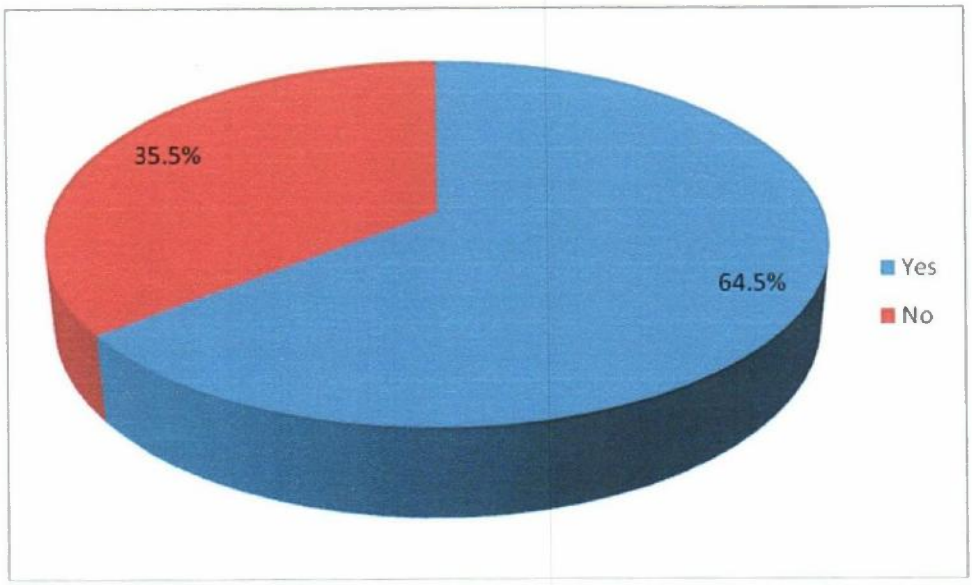
Table 4.16: Individual visits by EA by sex

		Individual visits by EA		
		No	Yes	Total
Sex of respondent	Male	35 (30.7)	79 (69.3)	114 (100)
	Female	49 (57.0)	37 (43.0)	86 (100)
	Total	84 (42.0)	116 (58.0)	200 (1000

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

Fig 4.5 shows the responses with respect to visits to groups and communities. Understandably, the visits or coverage has improved from 116(58 %) to 129 (64%). Extension agents visit more in groups than they do for individuals. During a focused group discussion some community members complained bitterly about the activities of Extension Agents. One lady lamented, "The field officers are discriminating. When they come to the community they only look for their people – their group members. No one comes to me"

Figure 4.5: Group/community visits by EA



Source: Field survey 2009.

The study also sought to find out how often EA visit their clients. In this area responses from farmers differed considerably from those of the EAs themselves. Farmers' responses are captured on table 4.16 below. According to the data, 49.1% of the farmers say they are visited monthly, 19% say fortnightly and 17% say its weekly. Clearly majority say the visits are one month or beyond. However, field officers have a different view.

Table 4.16: Frequency of visits from farmer' view

How often do EA visit your group /community?	Frequency	Percent
Weekly	20	17.2
Fortnightly	22	19.0
Monthly	57	49.1
Quarterly	13	11.2
Other	4	3.4
Total	116	100.0

Source: Field survey 2009.

Field officers from PAS GARU, MoFA and ZOVFA were asked how often they visit their communities. Of the 16 officers who responded to this question, 56.2% said they visit fortnightly while 31.2% said weekly. Thus 87.5% of field officers visit either weekly or fortnightly. This is supported by only 36.6% of farmers interviewed. According to the Training and visit system adopted by MoFA, farmers are supposed to be visited fortnightly. In principle field officers of the Presbyterian Agricultural Station also visit their communities fortnightly. Clearly there is difference between the planned visits and the actual implementation. Some of EAs admitted during interviews that they are unable to visit farmers as required because of other activities like workshops and special assignments that are given from time to time.

During the focus Group Discussions, farmers made it clear that inadequate and irregular visits from extension officers is a source of worry.

Table 4.17: Frequency of visits from field officers' view

How often do you visit a community?	Frequency	Percent	Cumulative Percent
Weekly	5	31.2	31.2
Fortnightly	9	56.2	87.5
Monthly	1	6.2	93.8
Other	1	6.2	100.0
Total	16	100.0	

Source: Field survey 2009.

4.4.3 Activities of extension agents.

The activities of extension agents in the communities are quite extensive. Respondents were asked to list specific activities that EAs carry out when they visit them. A wide range of answers were provided. These were clustered and classified according to themes or headings. The results are displayed on the Table 4.18. In all, there were 286 responses from the persons who answered that question. The highest score of 27.5% was in relation to training in livestock management. These include housing, feeding, disease control, hatching of eggs, choice of breeds, etc. The second score of 25% is training and sensitization on proper agronomic practices. Specific activities under this include early planting, land preparation, planting distances of various crops, fertilizer application, etc. The third most regular activity is the medication. Field officers also take part either directly or through the training of Community Animal Health Workers (CAHW) in the medication of livestock. These include vaccination against diseases and basic treatments such as de-worming, treatment of wounds, etc.

Table 4.18: Activities of extension agents

Activities of Extension agents	Frequency	Percent
Training in livestock management	55	27.5
Training & sensitization on proper agronomic practices	50	25.0
Medication of birds & animals against diseases	31	15.5
Sensitization on best farming practices	26	13.0
Compost and manure preparation and management	22	11.0
Others	22	11.0
Supporting planting of trees	21	10.5
Livestock revolving scheme	18	9.0
Education on crop-livestock integration	11	5.5
Supply seed and other inputs to farmers	10	5.0
Support soybean/sorghum production	7	3.5
Facilitate access to Savings & credit	6	3.0
Group formation and development	3	1.5
Training in disaster management	2	1.0
Monitoring visits	2	1.0

Source: Field survey 2009.

The fourth most regular activity cited by respondents is sensitization on best farming practices. The fifth group of activities mentioned was in relation to compost and manure management. Thus kraal bedding, compost making and general issues relating to organic manures were mentioned. The next activity of significance is that of tree planting. These include support in terms of providing tree seedlings, sensitization on the need to plant and protect trees, as well as training on how to care for trees. Several other activities were mentioned including education on crop-livestock integration, facilitating group formation and development, linkages to credit sources, supply of inputs to farmers, activities relating to cash crop production, trainings in disaster management, monitoring and marketing of produce.

As can be intimated from the above the typical extension agent is everything and does everything. Apart from these activities that relate to farming activities, several other activities were cited in relation to activities that do not relate directly to farming. These

include health education, sensitization on use of mosquito nets, sanitation, HIV/AIDS sensitization, nutrition education, gender and a host of many others.

4.4.4 Extension service providers

Community members listed all the organizations that support their farming activities in any way. The result is what is captured on Table 4.19. Although some organizations such as Care International and PAGEV (Based in Burkina Faso) are active in the area, they are not involved in direct implementation but work through partners (PAS Garu and ZOVFA).

Table 4.19: Extension service providers in the Garu Tempane District

Name of organization	Frequency	Percent
1. BESSFA Rural Bank	3	2
2. Ghana Cotton Company	9	5
3. MoFA	33	19
4. PAS G	110	64
5. ZOVFA	13	8
6. CBR	1	1
7. Red Cross	1	1
8. Oncho	1	1
Total	171	100

Source: Field survey 2009.

From the results displayed on Table 4.19, three organizations appear to be the main ones directly involved in agricultural extension services. The GCCL provides extension and marketing services to farmers engaged in the cultivation of cotton. On the basis of the results in the Table 4.19 three of the extension providers with highest score will be briefly discussed. They are Zuuri Organic Vegetable Farmers Association (ZOVFA), the Ministry of Food and Agriculture (MoFA) and the Garu Presbyterian Agric Station (PAS Garu).

Zuuri Organic Vegetable Farmers Association (ZOVFA)

ZOVFA operates in 8 communities within the study area. Its main office is located at Binduri in the Bawku Municipality. It is active in three of the communities covered by this research – Tankpansi, Nomboko and Kugrasia. The organization was established in 1994 and has been supporting farmers especially in environmental management. Field officers of ZOVFA provide capacity building in the areas of tree planting, compost making and land management. ZOVFA tries to live by its name, by its principled stand on organic farming. It frowns on the use of agrochemicals including fertilizer and pesticides. They engage in livestock medication by training Community Animal Health Workers (CAHW) to take up basic medication in the communities.

Ministry of Food and Agriculture (MOFA)

The Ministry of Food and Agriculture (MOFA) opened its district office in the study area when the Garu Tempane District was carved out of the then Bawku East District in 2004. The District is divided into 3 zones and each zone further divided into 8 operational areas. A zone should be manned by a supervisor while an operational area is overseen by an Agricultural Extension Assistant (AEA). However the new extension system has no place for zonal officers. Rather it provides for district officers in the various sub sectors including extension, livestock, crops, veterinary services, engineering, Women in Agriculture, Plant Protection and Regulatory Services, and information

In an interview with the District Extension Officer, he indicated that there were only 7 AEAs in the district to oversee the 24 operational areas. Under the Training and Visit (T&V) system of extension, an operational area is divided into 8 sub operational areas. The AEA is expected to facilitate 2 farmer groups in each sub operational area. (S)he will meet one group in the morning and the other in the afternoon to share new technologies. Thus four groups will be facilitated in week one and the second four will be met the following week. Monday to Thursday is used for meetings while Friday is regarded as a flexible day to make up for failed meetings and follow-ups. The Research Extension Linkage Committee meetings ensure that farmers' concerns are taken on board. However, in practice these committee meetings are not effective.

Garu Presbyterian Agricultural Station (PAS Garu)

The Garu Presbyterian Agricultural Station (PAS Garu) was officially established in 1967 by the Presbyterian Church of Ghana to work towards improving the living standards of the people in the area. The station has since been engaged in agricultural extension and community development. The working area of the station covers almost the entire Garu-Tempane District and parts of the Bawku Municipal Assembly and Bawku West District.

The mission of the station is "to promote equitable and sustainable income and food security through the provision of integrated agricultural extension services to the farming communities around Garu-Tempane and Bawku West Districts and Bawku Municipality".

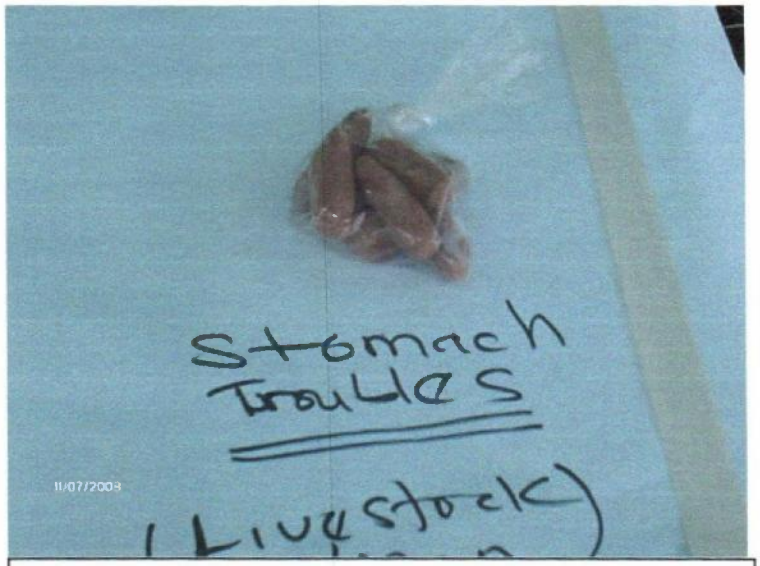
PAS Garu has a number of thematic areas that guide the implementation of extension service provision. These were carved out during the formulation of its strategic plan and include the following:

- Commercialization and agribusiness
- Access to finance and markets
- Food security and alternative livelihoods
- Capacity building
- Cross-cutting issues (gender, environment and advocacy)
- Collaboration and partnership with government and allied institutions
- Resource mobilization
- Program coordination, monitoring and evaluation

PAS Garu operates with a number of strategies developed over the years. The station believes in partnership building and working in partnership. This is at two levels: at the level of the clients and at the level of other development actors.

The Participatory approach is another key strategy that the organization dearly uses. Farmers are knowledgeable and have a rich experience to share. They have survived all these years of challenges imposed by changing economic and climatic conditions. The station has been using this approach in all its interventions.

Figure 4.6: A sample of ethno-veterinary drugs in use



This is a sample of local drugs exhibited by Win Yuuma, during the launching of the station's campaign against misuse of agro chemicals in 2009.

The concept of Low external inputs & sustainable agriculture (LEISA) has been taken up and has become one of the guiding principles being used by the station. The station also encourages the use of indigenous knowledge practices that have been tried and tested. It is common for the station to mount a stand on a National Farmers Day where farmers display traditional products. Figure 4.6 shows an example of local drugs displayed by one of the leading farmers in the area of operation.

PAS Garu has been mainstreaming cross cutting issues like Gender, HIV/AIDS, environment, into its programmes. Thus every project and activity is analysed to determine how its implementation will affect men, women and children. The Rights

Based Approach has recently been adopted because of the station's believe that poverty should be seen as denial of access.

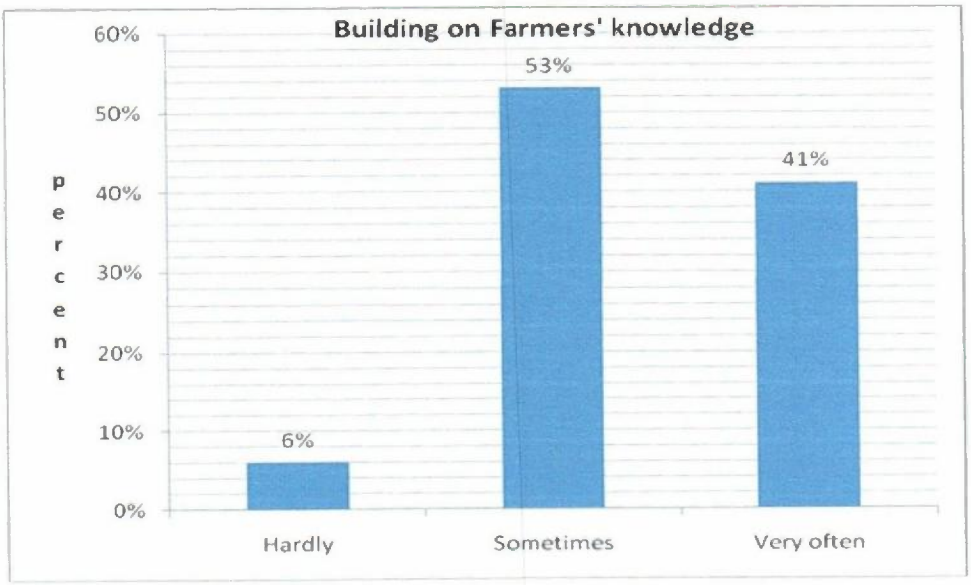
The working area of PAS Garu is divided into 4 zones. Each zone is manned by a zonal officer and a programme officer. The programme officer oversees the zonal officer but also is in charge of a minimum of 5 communities.

Desk officers or focal persons have been appointed to be in charge of Monitoring and Evaluation and program areas like Gender and advocacy, Market Access, agri-business, Micro Enterprise Development, Community Water, Village Savings and Loans and the Food and Agricultural Recovery Management (FARM) Project.

4.4.5 Building on farmers' knowledge

The research sought to find out how often officers build on farmers knowledge as a rough indicator of how far they have moved from the transfer of technology concept. Out of the 150 people who responded to that question, 40% say it is often, 32.7% say it has been minimal and 27.3% say it was very often. This picture gives the impression that the EAs are really identifying and building on the knowledge of the farmers. However, a look at the responses of field officers themselves gives another view. Out of the 17 field officers who responded to the question how often they identify and build on farmers' knowledge, 52.9% say they sometimes do it while 41.2% say they often do it. One person or 5% hardly builds on farmers' knowledge. One must concede that four (4) out of ten (10) AEs consistently building on farmers' knowledge is an improvement.

Figure 4.7: Field Officers' view of how often they build on farmers' knowledge



Source: Field survey 2009.

The other interesting part of it is that some field officers do not think that the farmers even have the capacity to generate new knowledge. This is evident in responses to the question; "do some of your farmers generate their own new knowledge or modify technologies provided by extension?" The responses are captured on Table 4.20. According to responses on the table, 4 persons representing 23.5% answered in the negative.

Table 4.20: EAs view of farmers' ability to generate/ modify new knowledge

Do some of your farmers generate or modify new knowledge/technology?	Frequency	Percent
Yes	13	76.5
No	4	23.5
Total	17	100.0

Source: Field survey 2009.

Given the level of discussions concerning the importance of farmers' knowledge, one would have expected all the EAs to indicate yes. It is evident that if you do not believe in the ability of farmers to generate or modify knowledge you surely cannot build on it because it does not exist! Such a stance clearly has roots in the failed transfer of technology approach that sees scientists as innovators and farmers as adopters but not as sources of innovation in their own right (Gottret 2007).

Table 4.21: Farmers' view of how often EA build on famers' own knowledge

How often does the EA build on your knowledge?	Frequency	Percent
Minimally	49	32.7
Often	60	40.0
Very often	41	27.3
Total	150	100.0

Source: Field survey 2009.

Gupta (1992) contends that while searching for innovations, people have drawn negative inferences about the innovative potential of peasants. They were either looking for the wrong things, or looking through inappropriate prisms, or asking the wrong questions in the wrong places. This attitude usually leads to undesirable results or failed interventions as depicted by Millar (2008:93). He concludes that the "efforts to introduce the green revolution, cash crops and to train farmers to become entrepreneurs have not resulted in the expected outcome. This is mainly due to the fact that they were not rooted in African knowledge systems and did not take into account the specific ecological and socio-economic conditions."

Simpson (1999) argues that surprisingly little has been done on a systematic and broad-scale basis, despite the rhetoric around building on farmers' knowledge and practices. One cannot agree more with him. People must practice what they preach.

Field officers were also requested to indicate how they support new knowledge among farmers. Since respondents could provide more than one response, a total of 35 were recorded. I clustered and classified them according to themes. Table 4.22 is the result of that.

From the table 65% of respondents said they facilitate the trying and testing of such knowledge through various mechanisms such as farmer field schools, demonstrations, trials, etc. 47% said they create a platform for such farmers to share their knowledge and best practice with their colleagues. This is in the form of field days, open days, etc. 35% of the respondents say they provide moral support through encouraging words, follow up visits, monitoring and similar forms. 29 % talked of building capacity through training, arranging exchange or learning visits. 18% of responses said they resource farmers to implement their innovations.

Table 4.22: Supporting farmers' new knowledge

How new knowledge is supported	Frequency	Percent
Facilitate the trying and testing of such knowledge thro FFS, etc	11	65
Create platform for farmers to share their best and production practices	8	47
Moral support by follow-ups and bridging gaps, verbal etc	6	35
Build capacity of farmers thro exchange visits, training, etc	5	29
Resourcing and supporting new knowledge generated	3	18
Using lead farmers	2	12

Source: Field survey 2009.

4.4.6 Rating extension services and the products provided

The research found that people value the services being provided by organizations in extension delivery. From table 4.23, of the 172 who responded to that question, 86.3% say the services are very good or good, while 18% say it is fair or poor. When we further disaggregate the data according to sex the picture we get is that, more men are satisfied with extension services than women. If we assume that the rating "fair" and "poor"

represent levels of dissatisfaction, then we can see from the data that whereas 18% of men are dissatisfied with extension services, 24.3% of women are dissatisfied. However, a chi square calculation showed no significant difference (P=0.077), but clearly more women are less satisfied with extension services than men. Thus field officers are not able to adequately meet the needs of women farmers.

Table 4.23: Rating extension services by sex

Rating	Sex of respondent		Total
	Male	Female	
Very good/Good	88 (86.3)	53 (75.7)	141 (82.0)
Fair/poor	14 (13.7)	17 (24.3)	31 (18.0)
Total	102 (100)	70 (100)	172 (100)

Chi Square test: P=0.077

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

Famers were requested to rank the services being provided by the various organizations involved. The services were: knowledge/information, inputs/materials, credit/financial services, market access and other services. Each organization's services under these headings were to be ranked as 'very important', 'important' and 'not so important'. Each respondent listed all organizations providing services in the community and ranked each service separately. Table 4.24 is the summary of all the entries that were made by farmers. On top of the list of services is the provision of knowledge and information. This item does not just lead in the number of entries (65). 65% of respondents who entered for this service regard it as either very important or important. Thus farmers appreciate the training sessions, exchange visits, advisory services, information, etc. that organizations provide. The next service after knowledge is access to inputs and other materials with a total of 64 entries. During focus group discussions farmers indicated that access to quality seed, agro chemicals especially fertilizer is very important. As reflected on the table, 86% of farmers see this category as very important or important. The provision of credit and

other financial services follows closely with a total of 56 entries. Contrary to the general perception that farmers are always looking for credit, respondents indicated that 29% of services under this category are not so important. However, one may not lose sight of the fact that it is a service provided for those with capacity to pay back. In this sense those not benefiting directly may give a low rating to it.

Table 4.24: Farmers' ranking of services provided

Intervention/service	Very Important	Important	Not so Important	Total
Knowledge/information	42(65)	19(29)	4(6)	65(100)
Inputs/materials	34(53)	21(33)	9(14)	64(100)
Credit/financial services	29(46)	16(25)	18(29)	63(100)
Market access	28(45)	7(11)	27(44)	62(100
Other services	0	1(25)	3(75)	4(100)

Source: Field survey 2009. Note: Figures in parenthesis are percentages.

The fourth in the list is market access with total of 62 entries. According to the study, 44% of the services in this area are not so important. According to the organizational rankings only PAS Garu and the Ghana Cotton Company Limited (GCCL) recorded high ratings in this category. This is understandable considering that GCCL is virtually the sole buyer of cotton in the study area and that PAS Garu provides market for sorghum and soybeans under its market access programme. The low rating of the service can also be attributed to the fact that it is a specialized service limited to those engaged in the cultivation of cotton, sorghum and soybeans. Moreover the market access programme of PAS Garu is targeted at Farmer Based Organizations (FBOs).

4.4.7 Gaps/challenges in extension service delivery

All field officers who responded to the questionnaire conceded that there are gaps in the extension service delivery of their organizations. When asked to list the gaps, they provided a wide range of answers. Since respondents could name more than one gap there were 38 responses in all. These were clustered and classified into 5 broad areas. The summary is presented on Table 4.25.

Table 4.25: Gaps in extension delivery

Nature of gap identified	Frequency	Percent
Overall organizational strategy	10	59%
The farmers are to blame	9	53%
Inadequate staff	8	47%
Low staff capacity	6	35%
Inadequate funds and or logistics	5	29%

Source: Field survey 2009.

As can be verified on the table 4.25 above the responses are quite even. The highest score of 59% is associated with the strategy being used by the organization. Some of the gaps identified under this area include conflicting strategies being used by some organizations, thereby confusing the farmers. Others said there are poor linkages especially between extension and research and therefore with farmers. This was evident in the responses given by extension agents concerning the extension approach being used by their mother organizations to deliver extension services. Apart from the senior staff members there was general misunderstanding on the concept of approach. Some extension agents accused their mother organizations of engaging in contradictory policies in order to meet donor terms.

The second highest score of 53% as usual put the blame on farmers. Specific responses were that farmers are difficult, not educated, selfish and not understanding. Third score of

47% has to do with the adequacy of field officers. Respondents poured their frustrations concerning their inability to reach out to several farmers and communities due to few staff numbers. There is therefore a huge gap in relation to accessing the services of extension providers. The fourth score of 35% placed the blame on low staff capacity. The complexity of modern extension requires the staff to possess a certain level of skill and competence in order to effectively facilitate community processes. Finally 29% said inadequate funds and other logistics is the gap preventing effective extension delivery.

4.4.8 Improving extension services

Improving the effectiveness of agricultural extension is the concern of this study. This view was sought from both the beneficiaries and the extension providers. The responses of the two groups will be discussed in separate sections.

a. View of extension agents on how to improve extension

18 extension officers from three service providers were requested to suggest ways of improving agricultural extension delivery of their respective organizations. A total of 40 suggestions were made and these have been collated and produced in Table 4.26.

Table 4.26: Extension agents' view of how to improve services

How to improve agric extension	Frequency	Percent
Link up with other organizations that provide extension	10	59
Build capacity of field staff to deliver	8	47
Motivate staff and provide adequate logistics	6	35
Recruit more extension staff	5	29
Build the capacity of farmers	4	24
Agric extension services should extend to other communities	3	18
Use community Based extension approach	3	18
Use PTD to stimulate ownership and uptake of new technologies	1	6

Source: Field survey 2009.

According to the results contained on table 4.26, the issue that tops the list with 59% is linking up with organizations that provide extension services. Officers say that linkages especially with research and other service providers are weak and should be strengthened. This will eliminate duplication and promote efficiency in resource use. PAS Garu and MOFA have been working together from the inception of the two organizations. They hold joint meetings and attend some programmes organized by either organization. The District Director of MOFA serves on the Advisory Board of PAS Garu where issues of policy and implementation are discussed. A cordial working relationship thus exists between them. Notwithstanding these efforts the organizations can move beyond that.

In relation to this issue, Opondo et al, (2005) posit that the farmer innovation system approach allows for interactions and integration between stakeholders, resulting in social learning. This enables the stakeholders to identify and recognise their experimentation efforts, responsibilities, strengths and weaknesses, thereby strengthening participation and community innovation processes.

The second issue is the call for capacity development of staff, with a core of 47%. Staff members of the relevant organizations say they are sometimes at their wits end in dealing with some of the issues that arise on the field. As was noted before the new extension worker is a facilitator who must support communities, FBOs and households to deal with complexities in the business of farming. Thus the call for regular capacity building of field officers can be understood from this perspective.

The third on the list is providing staff with motivation and logistics. It has a score of 35%. Field officers say they are not motivated enough to do their best. In addition, lack of logistics frustrates the worker further and ultimately affects the quality of services provided. Most of the suggestions under this were from the Ministry of Food and Agriculture (MOFA).

The fourth score is in respect of increasing staff numbers 29%. Extension agents say they are unable to cope with the number of farmers that require their attention. Recruiting more staff will enable them reach more communities and farmers.

b. View of farmers on how to improve extension

Just like the extension agents, farmers were asked to suggest how extension services can be improved by those who provide the service. The first suggestion made by each of the 186 farmers who responded to the question were collated and classified into themes and presented on Table 4.27 below. Unlike the section on extension officers, the entries made in this section correspond with the number of respondents.

From Table 4.27, the farmers made 8 main suggestions for improving extension delivery. The one with the highest score of 53 entries (representing 27% of farmers interviewed) is providing regular and quality training for farmers. This particular suggestion corroborates the section on ranking extension products where farmers ranked knowledge and information was rated highest among services. Farmers particularly mentioned training in best practices, information on new techniques in crops and livestock sectors. They also

talked about the need for group capacity development and also to improve the quality of information provided to farmers.

Table 4.27: Farmers' view on how to improve extension

How to improve extension delivery	Frequency	Percent
1. Provide regular and quality training for farmers	53	27%
2. Expand to cover more farmers & communities	37	19%
3. More frequent and timely visits	30	15%
4. Support farmers to access farm inputs like fertilizer, chemicals, etc.	25	13%
5. Extension services for farming activities should continue	15	8%
6. Support farmers with credit so that they can do their farming activities	8	4%
7. Extension providers should help to identify proper marketing sources	4	2%
8. Other suggestions	14	7%

Source: Field survey 2009.

The second group of suggestions has a score of 37 representing 19% of the respondents. They request extension providers to expand services to cover more communities and farmers. Some farmers suggested that volunteers be recruited and trained to fill the gap. Others said more groups should be formed to increase coverage. Yet others said more workers should be employed to reach more people.

The call to expand services is not new. As was indicated before, the extension service providers are seriously understaffed. MOFA has 7 AEAs instead of the required 24. This gives an average of 3.4 operational areas per AEA instead of one. PAS Garu has a total of 10 field officers – which cannot cover the entire study area. As contended by some of the farmers, providers of extension must change their ways of working and strategize to fill the yawning gap.

The Community Based Extension (CBE) approach should be explored in earnest. All the service providers – PAS Garu, MOFA and ZOVFA - have pilot communities where the

CBE model is being tried. In the current situation where resources may not be readily available to recruit more staff, the most viable option is to upscale its operation to other communities. This strategy ensures that selected community members are strengthened to carry out basic essential services to bridge the unacceptable gap.

The third suggestion with a score of 30 respondents (15%) is a call for improving the frequency and timeliness of visits. This point was passionately reinforced during FGD in four of the study communities. Farmers said they do not see their officers regularly. They also want support to be timely. In one community, they pointed out that a maize demonstration farm failed because the inputs came very late.

The fourth suggestion was made by 25 (13%) of the respondent farmers. They said extension officers should support farmer to access inputs for their farms. Some of the inputs listed include seed, fertilizer, pesticides and veterinary drugs. This item was dominated by the difficulty of accessing the subsidized fertilizer.

The fifth group was made by 15 respondents (8%) is actually not a suggestion but an endorsement of the current system. They say the extension services for farming activities should continue. Many of them said they thank the officers for the work they have been doing while others prayed for God to bless them for their services.
The sixth suggestion was made by 8 respondents (4%) and they have asked extension agents to make credit and other financial services available to farmers. The last definite one is in relation to marketing. Some farmers want the institutions involved in extension to provide proper market linkages to enhance their income.

Before drawing the curtain on this section it will be good to return to the Agricultural Information Systems (AIS) concept. As was noted in the literature review AIS concept recognizes a broad range of actors and disciplines/sectors involved in innovation, particularly the private sector in its many guises along the value chain (Hall et al, 2006). It recognizes that creating an enabling environment to support the use of knowledge is as important as making that knowledge available through research and dissemination mechanisms. It potentially offers a framework for embedding innovation capacities in the

rapidly changing market, technological, social, and political environment of contemporary agriculture. From the interactions with extension service providers, it is my view that they have not arrived at the AIS yet. However, PAS Garu has been working on certain value chains like soybeans, sorghum and are planning to add more. The others are operating at the level of the Agricultural Knowledge and Information System where interactions and stakeholder consultations are embarked upon.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The study shows that majority of farmers; indeed 154 (representing 77%) do not have any formal education. A gender disaggregation of the figures is more revealing as 91.5% of the women farmers did not have any formal education. This is the epitome of the gender disparities that characterize the study area and the North in general.

The results of the study also show that majority of extension officers are men. Moreover, the male extension officers are far ahead of their female counterparts in the area of academic qualification. For instance, almost 60% of male officers had either a first degree or masters while that of females is 40%. This definitely has an effect on the extension provided to female farmers.

The majority of farmers interviewed indicated that they engage in both crop and livestock production activities. On the whole 152 persons representing 76% say they are into both crops and livestock. Most of the people who indicated either crops or livestock are women. Thus while over 91% of men are into both crops and livestock, only 50% of women engage in both.

The study area is characterized by small land holdings. Out of the 200 farmers interviewed 107 or 53.5% have farm sizes of between 1 and 4 acres. However, 76 of the persons in this category are women. Specifically, 88.4% of women have farm sizes of between 1 and 4 acres whereas 27.2% of men are in this same category. It is clear from the results that, whereas the average farm size of men is 5 acres and beyond, that of the women is between 1 to 4 acres. This is in conformity with the findings of Van Huis and Meerman (1997) that most farmers in sub-Saharan Africa have small holdings of less than 2 ha in West Africa.

Land preparation is usually carried out at the onset of the rainy season. From the study findings, bullock ridging is the dominant method. This is because 179 or 89.5% out of the

total respondents indicated they use bullocks to prepare the land. None of the respondents indicated the use of a tractor. This confirms findings of studies to the effect that animal traction is extensively used in the area (Blench, 2005).

The use of family labour remains the most important source of labour in the study area as 124 respondents or 62% say they get their main labour from that source. Hired labour has also become important, taking 28% of the sources.

A wide range of crops are grown in the study area. The common ones that were mentioned include millet, sorghum, maize, soybeans, rice, groundnut, cotton and cowpea. Onion and pepper were also mentioned for dry season gardening. It is to be noted that the study area is noted for dry season activities. On the part of livestock, farmers keep poultry, small ruminants (sheep and goats), pigs and cattle.

The study found that farmers use every available opportunity to spread information on farming issues amongst themselves (Nathaniels, 2005). Most of the people do it within the informal setting: Drinking/pito bars, market places, during communal labour, personal contacts, and funerals. Those who belong to groups also make use of group meetings and community meetings to pass on information.

It was observed that traditional implements left behind by the immediate ancestors still constitute the main machinery in the farming business. These include the hoe, cutlass and knife. Bullock ploughing though a later addition has not replaced the hoe.

Respondents also mentioned a wide range of prescriptions for various situations that have been captured as "traditional treatment systems". Some of the things listed were the use of ash for preservation and also as treatment; use of various herbs for treating livestock diseases and traditional arrangements for preventing disease outbreak. Closely related but separate is traditional sacrifices to the ancestors for protection and for a good harvest. Thus while the Kusasi celebrate the Samanpiid as a thanksgiving to the gods, the Bimoba use the Danjour for the same purpose.

The issue of social support systems was not left out. As was discussed earlier monetization has not replaced family and communal labour in most of the study area. Tied to this is the system of seeking seed from relatives and friends.

Most farmers in the study area make their own changes on the farm over time. An overwhelming 91% of farmers covered by the research said they make such changes. Thus only 18 out of 200 said they did not make any changes in their practices. However, the figure for men respondents is higher (97.4%) than that if women which is 82.6%. It perfectly corroborates the assertion that when there was no extension service, farmers came up with ideas, carried out experiments and arrived at their own conclusions (Millar, 2008; Critchley, 2007; Okry and van Mele, 2006).

Most common changes made by farmers include the following:

- Introduction of new crop varieties.
- Improvements in the planting distances of some crops particularly sorghum, soybean and maize.
- Improvements in the management of manure and other organic fertilizers
- The gathering and use of crop residues for livestock feeding
- Other changes include early planting and harvesting, crop rotation, growing of water melon, livestock treatment, seed selection, soil/land conservation, dry season gardening and other miscellaneous practices.

The study sought to find out the source of the changes that farmers have made over the years. 50% of respondents attributed the source of the changes they made to extension agents. 30% of respondents trace the source of the knowledge to friends and 15% percent take credit in themselves. Most farmers tend to modify a lot of the technologies introduced by extension officers but they still find it expedient to give the officers the credit.

Various reasons were given by farmers for engaging in innovation practices. Most of the reasons given are economic. These include improving yields and consequently income

- Training & sensitization on proper agronomic practices
- Training in livestock management
- Training in disaster management
- Medication of birds & animals against diseases
- Monitoring visits

Many organizations were mentioned as development agents in the communities. Among them are the following: BESSFA Rural Bank, Ghana Cotton Company, MoFA, PAS Garu, ZOVFA, CBR, Red Cross and Oncho. On the basis of the findings, it is evident that the institutions that provide extension services are the Zuuri Organic Vegetable Farmers Association (ZOVFA), the Ministry of Food and Agriculture (MOFA) and the Garu Presbyterian Agric Station.

The study sought to find out how often field officers identify and build on farmers' knowledge. 53% say they sometimes do it, while 41% say they often do it. One person hardly builds on farmers' knowledge. Moreover, 23.5% of field officers interviewed said they did not believe some of their farmers could generate their own new knowledge or modify technologies provided by extension. It is evident that if one does not believe in the ability of farmers to generate or modify new knowledge there will be nothing to build on.

Field officers use various methods to support new knowledge among farmers. Some of the methods used to support new knowledge include the following:

- Facilitate the trying and testing of such knowledge through FFS, etc
- Build capacity of farmers through exchange visits, training, etc
- Create platforms for farmers to share their best and production practices
- Resourcing and supporting new knowledge generated
- Moral support by follow-ups and bridging gaps, verbal etc
- Using lead farmers

The research found that farmers value the services being provided by organizations in extension delivery. From the farmers who responded to that question, 57.6% say the services are very good, 24.4% say it is good while 13.4% say it is fair. A disaggregation of the data according to sex reveals that more men are satisfied with extension services than women. Whereas 13.3% of men are dissatisfied with the extension services, 24.3% of women are dissatisfied. This could be traced to the fact that most of the field officers are men and being so are not able to adequately meet the needs of the women farmers.

The study found that out of the services provided by organizations, the provision of knowledge and information ranked first in terms of importance. 94% of responses indicated that the service is either very important or important. Thus farmers appreciate the training sessions, exchange visits, advisory services, information, etc. that organizations provide. The next service after knowledge is access to inputs and other materials. Farmers indicated that access to quality seed, agro chemicals especially fertilizer is very important. 86% of services in this category are regarded as very important or important. The provision of credit and other financial services follows next. However, 29% of services under this category are not so important. The fourth in the list is market access. According to the study, 43% of the services in this area are not so important.

All field officers who responded to the questionnaire conceded that there were gaps in the extension service delivery of their organizations. The gaps were summarized under the following headings:

- Overall organizational strategy
- The farmers are to blame
- Inadequate and low staff capacity
- Inadequate funds and or logistics

Extension officers from three service providers suggested ways of improving agricultural extension delivery of their respective organizations. The list is provided below

- Link up with other organizations that provide extension
- Build capacity of field staff to deliver
- Recruit and motivate extension staff and provide adequate logistics
- Agriculture extension services should extend to other communities
- Use community Based extension approach
- Build the capacity of farmers
- Use PTD to stimulate ownership and uptake of new technologies

Farmers also provided their view as to how extension services can be improved by those who provide the service. Below is a summary of their views:

- Provide regular and quality training for farmers
- Expand to cover more farmers & communities
- More frequent and timely visits
- Support farmers to access farm inputs like fertilizer, insecticide, etc.
- Extension services for farming activities should continue
- Support farmers with credit so that they can do their farming activities
- Extension providers should help to identify proper marketing sources

Extension service providers have not fully applied the AIS yet. However, PAS Garu has been working on value chains like soybeans and sorghum and are planning to add more. The others are operating at the level of the Agricultural Knowledge and Information System where interactions and stakeholder consultations are embarked upon.

5.2. REVISITING THE RESEARCH QUESTIONS

The first specific research question is; what traditional systems/structures support farming activities in the communities? This question gives rise to the objective, to identify traditional systems that support farming activities. The farming business in the area is intertwined with socio-religious practices of the people. This is the case notwithstanding the fact that Christianity and Islam have made significant inroads in the area under

scrutiny. The study unearthed a myriad of traditional systems and practices that contain the business of farming in that area. Some of these include protection of the gods of the land during the farming season; traditional treatment systems for both crops and livestock, social support for labour and farm inputs, information sharing among relatives and friends in the normal course of living. Also important is the changing use of traditional festivals to engage in development planning and social mobilization.

Practices that sustain the fertility of the soil such as the use of animal and human wastes to apply on the farmland are still in vogue. Moreover, traditional crops such as millet, sorghum; cowpea, groundnuts, rice and maize constitute the backbone of the cropping system. Cotton and soybean have been added as cash crops though. The hoe continues to be an important piece of equipment being used by farmers in the area.

The second research question that confronted the study is; what farmer innovations are available in the communities? The ensuing objective to this question is to investigate what farmer innovations are available in the communities. The study established that farmer innovations abound in the communities. This issue has been sufficiently dealt with in the study. Indeed, most farmers in the study area make their own changes on the farm over time. An overwhelming 9 out of 10 farmers covered by the research said they make such changes. Some of the changes mentioned include the introduction of new crop varieties; improvements in the planting distances of some crops; improvements in the management of manure and other organic fertilizers; gathering and use of crop residues for livestock feeding and many other changes such as early planting and harvesting, crop rotation, growing of water melon, livestock treatment seed selection, soil/land conservation, dry season gardening and other miscellaneous practices.

The fourth research question was framed as "what are the main extension approaches and strategies in the government extension service providers?" The relevant objective was to examine the extension approaches and strategies used by both the government and private extension service providers. This question has also been largely answered. MOFA still

uses the T and V system. The ministry in the study area has also adopted the community Based Extension (CBE) system in 10 communities.

The fifth research question stood as what are the main extension approaches and strategies being adopted by private extension providers like the Garu Presbyterian Agric Station? The object therefore was combined in the previous research. PAS Garu basically uses the integrated approach. It has also started the CBE in 6 communities with the hope of expanding to other places. The station uses a number of strategies to deliver extension including participatory approaches, promoting indigenous knowledge among farmers, mainstreaming cross cutting issues, rights based approach, low external input and sustainable agriculture and partnership building among clients and partners.

The sixth research question stood as "are there any gaps between extension services and farmer innovations?" The objective that went with it is to determine the gaps (if any) between extension service and farmer innovations. The research found that there are gaps between farmer innovation and extension service delivery. Some field officers do not even believe that farmers have any knowledge. Although over 90% of staff members said they build on farmers' knowledge less than half (41%) do it often while the rest either do it sometimes or hardly do it.

The penultimate research question was; "how can farmer innovations be incorporated into agricultural extension?" The research objective associated with it was "to examine ways of incorporating farmer innovations into agricultural extension services". This question received a number of useful responses which have been incorporated in the recommendations.

The last research question was "how can extension service delivery be made more effective?" This relates to the objective to make recommendations for extension service providers to improve their effectiveness. The study made a number of recommendations in the next section and these will hopefully contribute to the search for viable and effective extension service delivery. The study has sufficiently dealt with this question.

5.3 RECOMMENDATIONS

On the basis of the conclusions outlined on the previous section some recommendations are here outlined for the attention of extension service providers, policy makers, researchers and other development partners. It is the contention of this study that these will contribute to the on-going discourse on improving advisory services and by extension agricultural production.

The research found a wide range of traditional practices used by farmers. These have been captured as "traditional treatment systems". Some of the practices mentioned include the use of ash for preservation and also as treatment; use of various herbs for treating livestock diseases and traditional arrangements for preventing disease outbreak. Farmers have a vast knowledge system that is yearning to be harnessed. Extension agents and researchers must tap these experiences on a deliberate and consistent basis and not as an afterthought.

The study has established that most farmers in the study area make their own changes on the farm over time. An overwhelming 91% of farmers covered by the research did indicate that they have introduced something new in their farming practices Extension providers must necessarily seek to involve them in the development, testing and dissemination of new technologies. Researchers are urged to use the innovations of farmers and seek to improve upon them.

Extension service providers have not fully applied the AIS yet. The AIS concept emphasizes the application of knowledge (of all types) in production to achieve desired social or economic outcomes. From the analysis, AIS holds promise for unlocking the potential in small holder farmers. Extension service providers and policy makers are urged to fully apply the AIS frame work and create an enabling environment, knowledge development, use and exchange among farmers.

On access to extension services, 84 respondents representing 42% said they do not have access to such services. Disaggregating the responses according to sex reveals that only four (4) out of ten (10) women are likely to receive extension services. In contrast, seven (7) out of ten (10) men are likely to receive such service. Even those who enjoy the services complain of irregular visits. Given the under staffed nature of service providers, a strategy must be found to address this problem. Organizations providing extension like PAS Garu, MoFA and ZOVFA should consider expanding the community based extension system that seeks to strengthen local capacity to engage in the provision of basic support services in the communities.

Another way to expand coverage without employing more workers is to ensure that the issue of collaboration and networking is taken a step further. For instance it should be possible to cede certain zones to organizations to avoid duplication.

The study found that out of the services provided by organizations, the provision of knowledge and information ranked first in terms of importance. 95% of responses indicate that the service is either very important or important. It is clear then that farmers appreciate the training sessions, exchange visits, advisory services, information, etc. that organizations provide. These interventions should be continued and improved upon.

The results of the study also show that majority of extension officers are men. Moreover, the male extension officers are ahead of their female counterparts in the area of academic qualification. For instance, almost 60% of male officers had either a first degree or masters while that of females is 40%. This definitely has an effect on the extension provided to female farmers. This is a wakeup call on institutions that provide extension services to install a long term programme to engender extension services. In the mean time practical steps should be taken to make extension services more friendly to women's needs.

Finally, the field officers are the engine of an extension system. Accordingly, it is important that institutions engaged in the provision of the service must ensure that they

put people who are up to the task. The changing nature of the agricultural environment calls for a new extension officer – capable, reliable, confident and above all sociable. Thus painstaking human resource development efforts will be required to make the field worker the facilitator expected of him/her.

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B. SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Sex……..

   01= Male [ ]
   02= Female [ ]

2. Age……..

   01= 15 - 25 [ ]
   02= 26 - 35 [ ]
   03= 36 - 45 [ ]
   04= 46 - 55 [ ]
   05= 56 - 65 [ ]
   06= 66 + [ ]

3. Marital Status…

   01= Married [ ]
   02=Divorced [ ]
   03=Never married [ ]
   04=Widowed [ ]

4. Residential status:

   01=Native [ ]
   02=Migrant/settler [ ]

5. Do you belong to any farmer group?

   01=.Yes [ ]
   02= No [ ]

6. Religious inclination

   01= Traditional [ ]
   02= Moslem [ ]
   03= Christian [ ]
   04= No religion [ ]
   05= Others Specify…… [ ]

7. Main occupation. Tick where applicable.

   01=Farming [ ]
   02=Agro processing [ ]
   03=Trading [ ]
   05=Others [specify]……

8. Level of Education:

01= Primary school	[ ]
02= Middle/JSS	[ ]
03= Vocational/technical	[ ]
04= Secondary school	[ ]
05=Post secondary	[ ]
06=Polytechnic	[ ]
07= University	[ ]
08= N.A	[ ]

C FARMING AND COMMUNITY SYSTEMS

9. Which of the following type of farming do you practice?

1. Crop cultivation only	[ ]
2. Crop and livestock	[ ]
3. Livestock only	[ ]
4. Others specify.....	

10. What crops do you grow?

1. Millet	[ ]
2. Maize	[ ]
3. Sorghum	[ ]
4. Soybeans	[ ]
5. Groundnuts	[ ]
6. Cowpea	[ ]
7. Rice	[ ]
8. Bambara beans	[ ]
9.	[ ]
10.	[ ]

11. What is your total farm size?

1. 1- 4 acres	[ ]
2. 5 - 8 acres	[ ]
3. 8 – 12 acres	[ ]
4. 12+ acres	[ ]

12. What is your main method of preparing land for planting?

1. Tractor ploughing	[ ]
2. Hoeing (sok)	[ ]
3. Bullock ridging	[ ]
4. Other [specify].....	[ ]

Labour requirements

13. Indicate the most important source of labour for your farming activities.
    1. Family members [ ]
    2. Hired labour [ ]
    3. Friends/relatives [ ]
    4. Group support [ ]

    5. ..... [ ]

    6. ..... [ ]

14 Do you normally pass on information to other farmers?
01=.Yes [ ]
02= No [ ]

15 If yes, how do you pass on such information to other farmers?

1. .....

2. .....

3. .....

4. .....

16. Indicate any traditional systems that support your farming activities

1..... .....

2..... .....

3. ....

FARMER INNOVATION

17 Have you made any changes in your farming practices over the last 3 years?
1. Yes [ ]
2. No [ ]

18 What changes have you made?

1 .....

2 .....

3 .....

4 .....

19 From where did you learn of those changes?

1. Self [ ]
2. A friend [ ]
3. Extension agents [ ]
4. Others [ ]

20. What are the reasons for the change?

1 .....

2, ...

3. .....

21. Do you know of other farmers who have made changes in their farming practices?

1. Yes [ ]
2. No [ ]

22. If yes how many of such farmers do you know?

D. EXTENSION SERVICES AND APPROACHES

23. How do you usually get information on new farming practices?

1. Friends [ ]
2. Extension officers [ ]
3. Media [ ]
4. Others [specify] ..... [ ]

24. Have you been visited by any agric extension officer as an individual?

3. Yes [ ]
4. No [ ]

25. If the answer in 24 is yes, how often?

1. Weekly [ ]
2. Fortnightly [ ]
3. Monthly [ ]
4. Quarterly [ ]
5. Other (specify)..... [ ]

26. Have you been visited by an extension officer as a member of a group or community?

1. Yes [ ]
2. No [ ]

27. If the answer above is yes, how often are you visited?

1. Weekly [ ]
2. Fortnightly [ ]
3. Monthly [ ]
4. Quarterly [ ]
5. Other (specify)..... [ ]

28. Do you know the mother organization of the extension agents?

1. Yes [ ]
2. No [ ]

29 If yes kindly name the organization

1. MoFA [ ]
2. Agric Station (PAS G) [ ]
3. Ghana Cotton Co. [ ]

4. ..... [ ]

5 ..... [ ]

30. What areas of farming are covered by extension officers?

1. Crops only [ ]
2. Livestock only [ ]
3. Crops & livestock [ ]

4. Other .....

31. List the specific activities that extension agents do in relation to agriculture.

1. .....

2. .....

3. .....

4 .....

32. Apart from farming activities what other activities do extension agents do?

1.
2.
3.
4.
5.
6.

33. List the all the organizations that provide supporting services for your farming activities.

1.
2.
3.
4.
5.
6.

34. Please rank each organization/individual in terms of the goods or services it provides.
Ranking: 1 = very important; 2 = somewhat important; 3 = not so important

a. Organization/institution	b. Knowledge/ information	c. Inputs/ materials	d. Credit/ financial services	e. Market Access	f. others specify

35. Are extension service providers building on what you already know?
1. Yes [ ]
2. No [ ]

36. If yes, how often do they build on your knowledge?
1. Minimally [ ]
2. Often [ ]
3. Very often [ ]

37. How will you rate the extension services being provided to you or your group?
1. Very good [ ]
2. Good [ ]
3. Fair [ ]
4. Poor [ ]

38. What suggestions will you make to extension providers in order to improve their service delivery?

1 .....

2 .....

3 .....

4 .....

Formal institutional questionnaire

A. INTRODUCTION

This study is aimed at examining the nature of agricultural extension services being provided by various agents in relation to available farmer innovations in the Garu Tempane District. It will seek to provide recommendations for improving agricultural extension. The survey is for MPHIL thesis.

Dear respondent, your confidentiality is guaranteed.

B. GENERAL BACKGROUND INFORMATION.

Questionnaire Number.....

Name of Organization/Institution.....

Designation of Respondent.....

District/Municipality.....

Date of Interview.....

B. SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Sex……..

   01= Male [ ]
   02= Female [ ]

2. Age……..

   01= 15 - 25 [ ]
   02= 26 - 35 [ ]
   03= 36 - 45 [ ]
   04= 46 - 55 [ ]
   05= 56+ [ ]

3. Nature of employer organization

   01=Government [ ]
   02=Private [ ]
   03=Other [specify]

4. Staff category

   01=.Senior [ ]
   02= Junior [ ]

6. Religious inclination

   01= Traditional [ ]
   02= Moslem [ ]
   03= Christian [ ]
   04= No religion [ ]
   05= Others Specify…… [ ]

6. Rank. ……

7. Position in organization ……

8. Highest Level of Education:

01= Middle/JSS	[ ]
02= Vocational/technical	[ ]
03= Secondary school	[ ]
04= Agric college	[ ]
05= Polytechnic	[ ]
06= First degree	[ ]
07= Masters	[ ]
08= Other [specify]	

C FARMING AND COMMUNITY SYSTEMS

9. Which of the following type of farming do most of your clients practice?

1. Crop cultivation only	[ ]
2. Crop and livestock	[ ]
3. Livestock only	[ ]
4. Others specify.....	

10. What crops do your clients grow?

1. Millet	[ ]
2. Maize	[ ]
3. Sorghum	[ ]
4. Soybeans	[ ]
5. Groundnuts	[ ]
6. Cowpea	[ ]
7. Rice	[ ]
8.	
9.	

11. What is the average farm size of your clients?

1. 1- 4 acres	[ ]
2. 5 - 8 acres	[ ]
3. 8 – 12 acres	[ ]
4. 12+ acres	[ ]

12. Do your farmers normally pass on information to other farmers?

01=.Yes	[ ]
02= No	[ ]

13. If yes, how do they pass on such information to other farmers?
    1. .....
    2. .....
    3. .....
    4. .....

EXTENSION SERVICES AND APPROACHES

14. Do you have particular communities or farmers that you visit on a regular basis?
    5. Yes [ ]
    6. No [ ]

15. If the answer in 10 is yes, how often how often do visit a community?

    1. Weekly [ ]
    2. Fortnightly [ ]
    3. Monthly [ ]
    4. Quarterly [ ]
    5. Other (specify)..... [ ]

16. What extension approach or approaches does your organization use?

    1. ....
    2. ....
    3. ....

17 . What extension methods do you often use?

    1 .....
    2.....
    3. .....
    4. .....

18. What area of agriculture do you cover in your extension activities?

1. Crops only [ ]
2. Livestock only [ ]
3. Crops & livestock [ ]

4. Other .....

19 List the specific activities that you or your extension agents carry out in relation to agriculture.

1. .....

2. .....

3.....

4 .....

20 Apart from advisory activities in relation to farming what other community activities do you usually carry out as part of your extension work?

1. .....

2. .....

3. .....

4. .....

21. Are you satisfied with the level at which farmers adopt new technologies?

1. Fully satisfied [ ]
2. Partially satisfied [ ]
3. Not satisfied [ ]

22. Give possible reasons for your answer in 21.

.....

.....

.....

.....

23. Do some of your farmers generate their own new knowledge or modify technologies provided by extension?
    1. Yes [ ]
    2. No [ ]

24. If yes describe how you support or encourage such new knowledge

    i. .....

    ii. .....

    iii. .....

    iv. ....

25. How often do you identify and build on farmers' own knowledge?
    1. Hardly
    2. Sometimes
    3. Very often

26 Are there any gaps in your extension delivery system?
    1. Yes [ ]
    2. No [ ]

27. If yes, what gaps do you think pertain in your extension service delivery?

    1 .....

    2 .....

    3 .....

    4 .....

28. Suggest ways of improving extension services in your organization or catchment area

1 .....

2. .....

3. .....

4. .....

Appendix 3: Guide for FGD with group leaders and key informants

COMMUNITY SYSTEMS AND FARMER INNOVATION
Community support systems available for farming activities
Describe the traditional institutions and systems being practiced: crops, livestock, etc
Kindly describe the new or different crops, technologies, and practices that you are using. Have you introduced new crops over the last 5 years? What are these new crops?
Where and when did you learn about these new crops?
Are you doing anything different from past activities?
Where and when did you learn about new technologies or practices?
Have you adapted or changed these technologies or practices in any way?
Why are you doing things differently?
Why are you growing new crops or using new technologies or practices?
What sort of problems/risks did you face in doing things differently?
How has your life changed since you started doing things differently?
What is needed to enable more people to do things differently?

INSTITUTIONS/SERVICE PROVIDERS

List the organizations/individuals that are related to your farming activities.

- Goods or services that these organizations/individuals provide
- Knowledge/information
- Inputs/material
- Credit/financial services
- Market access)
- Other services (specify)

3. Please rank each organization/individual in terms of the goods or services it provides.

Organization/institution	Knowledge/ information	Inputs/ materials	Credit/ financial services	Market Access	Others services

Challenges

Suggestion for improving extension services